FEBRUARY 7, 1955

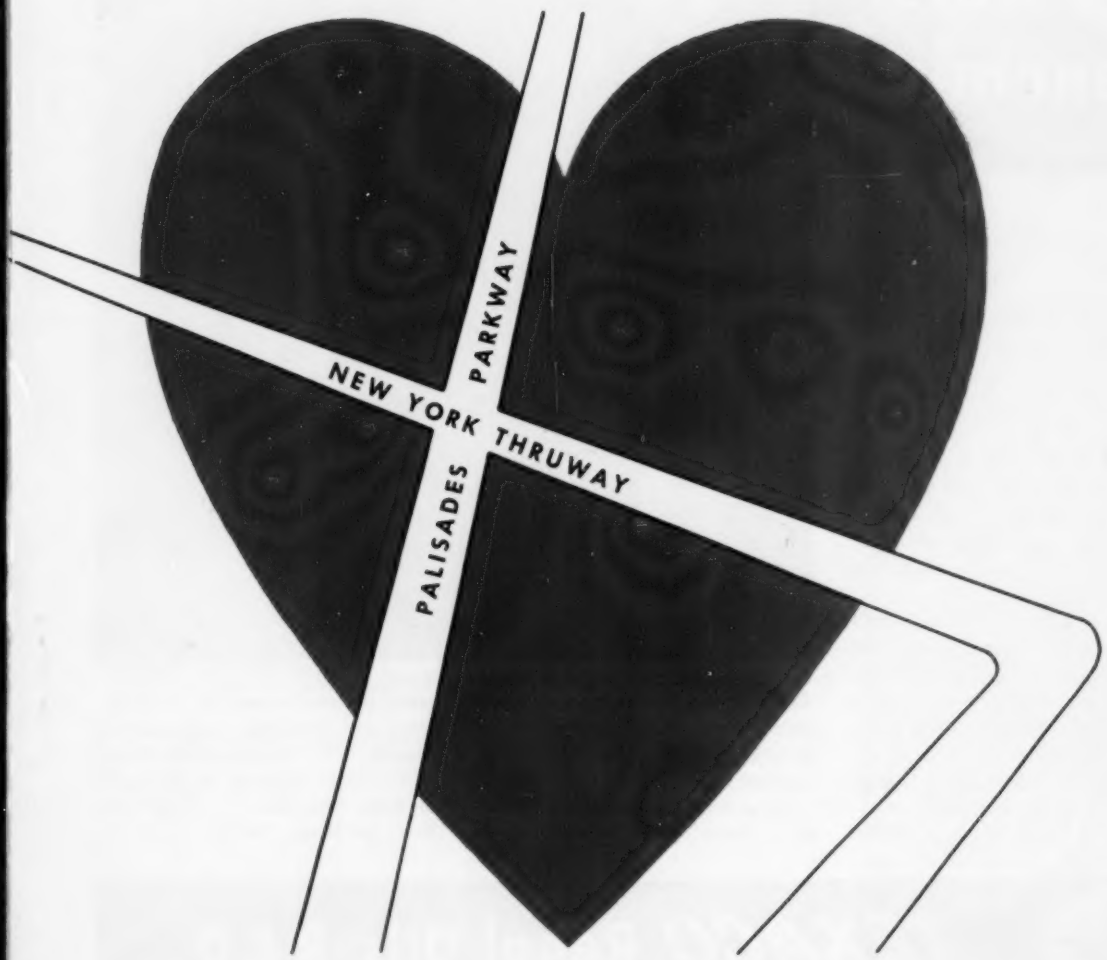
# Electrical World

PRICE 35 CENTS

A McGRAW-HILL PUBLICATION

***Its heart pierced by superhighways . . .***

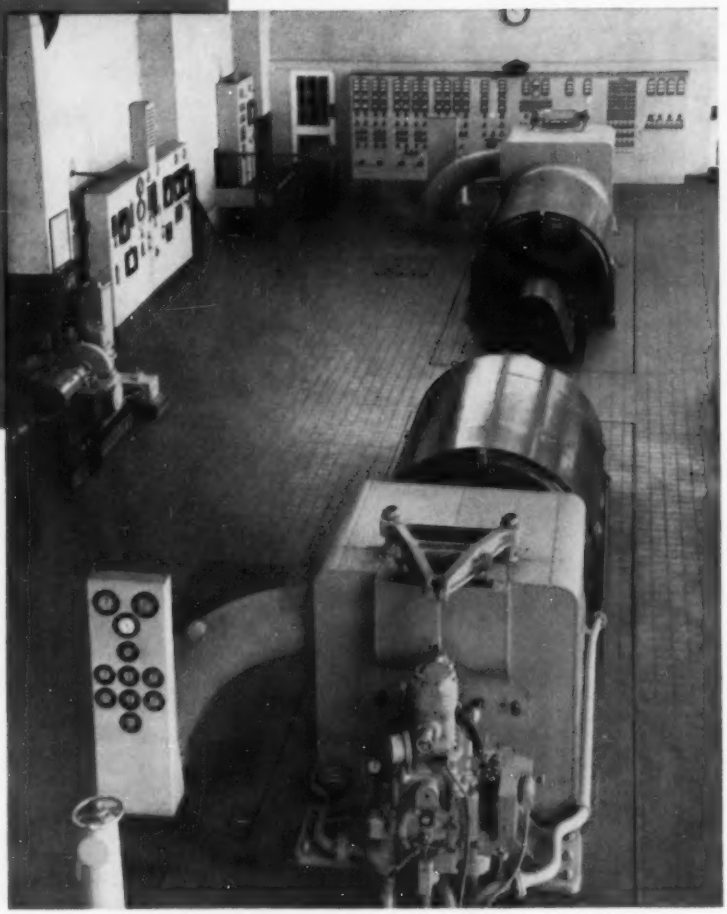
## Rockland L&P rebuilds its system . . . Page 62




**277/480-V Network Cuts Systems Costs . . . Page 69**

**System Planning Is Based on 100 Service Areas . . . Page 82**

# LIFETIME PROTECTION against a turbine's 3 worst enemies



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Use *Texaco Regal Oil R&O* and count on clean systems, instantaneous governor response, and longer bearing life. The naturally fine protective properties of *Texaco Regal Oil R&O* are definitely enhanced by special refining and the use of effective rust, oxidation and anti-foam additives.

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# Electrical World

Vol 143 No. 6 February 7, 1955

**EDITORIALS**—Pertinent comment on the industry's problems and accomplishments ..... 53

**THE ELECTRICAL WEEK**—Last minute news briefly told ..... 54

**NEWS**—Complete coverage of activities affecting the industry ..... 56

**FEATURES:**

**ROCKLAND L&P REBUILDS ITS SYSTEM** ..... 62

**WOOD VS STEEL TRANSMISSION LINES** ..... Lawrence M. Robertson 66

**277/480-V NETWORK CUTS SYSTEM COSTS** E. Rothfus, J. R. Oberholtzer, W. R. Folck 69

**HOLTWOOD'S NEW RIVER COAL UNIT** ..... J. Q. Wray, Jr., R. R. Bennett 75

**PRECAST MANHOLES CUT COSTS 35%** ..... J. A. Berner 79

**SYSTEM PLANNING IS BASED ON 100 SERVICE AREAS** ... Nicholas N. Smeloff 82

**HOW TO**— Practical ideas for those who design, construct, operate, and maintain ..... 85

**INDUSTRIAL APPLICATIONS** —Successful applications of electricity in industry ..... 114

**SALES AND SERVICE**—Commercial, rural, and residential uses of electricity 118

**MANUFACTURERS & MARKETS**—Information on electrical manufacturers and today's markets ..... 138

**NEWS ABOUT PEOPLE**—Personnel changes throughout the industry ..... 142

**FINANCE & REGULATION**—Securities and financing news ..... 160

**STATISTICS**—The industry's progress in figures ..... 163

• • •

Engineering Reference Sheet .. 96
New Equipment ..... 120
Books ..... 136
Catalogs and Bulletins ..... 136
Meetings Calendar ..... 144
Index of Advertisers ..... 151
Readers Forum ..... 154
Technical Notes ..... 158
Washington Comment ..... 158

Published for 81 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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# for DOUBLE SHEATH PROTECTION use Okolite-Okoprene control cables

The W. B. Tuttle Plant of the City Public Service Board, San Antonio, Texas.

A modern plant—in appearance and engineering—the W. B. Tuttle Plant of the City Public Service Board of San Antonio, Texas is the city's newest installation. Okolite-Okoprene control cables are used throughout the plant to control the 66,000kw output.

Okolite-Okoprene multi-conductor control cables give *double* protection. First, each conductor is given complete terminal-to-terminal protection by its own Okoprene sheath. Second, additional protection is provided by an Okoprene sheath over the entire cable assembly.

Okoprene is highly resistant to moisture, acids, alkalies, and heat. It is nonflammable and will not be corona-cut if ozone is developed by adjacent equipment. Thus, each conductor in Okolite-Okoprene multi-conductor control cables is protected twice against these dangers. This double sheath protection guarantees long cable life and reliable, round-the-clock circuit security.

For complete details on Okolite-Okoprene control cables, write for Okonite's Bulletin EW 1056-A. The Okonite Company, Passaic, New Jersey.

A multi-conductor, color-coded Okolite-Okoprene control cable.

2709

# Equipment for Line Construction and Maintenance

## via GraybaR

You can order all your heavy-duty equipment for pole line maintenance and construction from a single convenient source — makes and models known for their quality and reliability.

For example, if it's truck bodies you need, Graybar offers you all-steel units in various styles for construction, maintenance, and general service duties.

Winches and derricks? . . . We can match the right types of equipment to your needs — including models that will handle poles up to 70 feet in length.

For hauling cargo or poles, you can depend on Graybar for trailers and pole dinkeys that fit your needs exactly — whether your operations involve light- or heavy-duty service.

Perhaps right-of-way maintenance is your present concern. Let Graybar furnish your brush killer and spraying equipment. We can also recommend and supply the proper formulas for both dormant and growing season use.

Graybar provides a convenient, efficient source for procurement of all of your other pole-line needs, as well—poles, hardware, wire, strand.

A single responsibility for everything you need . . . when you need it. *Graybar Electric Company, Inc. Executive Offices: Graybar Building, 420 Lexington Avenue, New York 17, N. Y.* 408-92

*Call Graybar first for...*

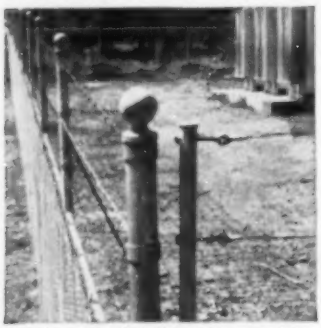
GraybaR Everything Electrical GraybaR ELECTRIC COMPANY

IN OVER 110 PRINCIPAL CITIES

# Weed and Brush Control lasts longer with Du Pont TELVAR® and AMMATE®

**Weed Killers** — **Weed and Brush Killer**

"Telvar" has kept this yard clean of vegetation for two years.



Note thorough job "Telvar" did around this fence. "Telvar" won't corrode fence or equipment; it's non-flammable, non-volatile.

Heavy weed growth around pole was controlled with one application of "Telvar." It's easily applied and extremely low in toxicity to humans and animals.

**One application of "Telvar"** solves weed problems for a season or longer!

"Telvar" kills through the roots . . . prevents regrowth. Low dosages (20 to 80 lbs. per acre) make it cost little for the results you obtain. Low rates also mean less handling, less storage facilities. If you're looking for a way to cut maintenance costs to new low levels, include "Telvar" in your weed-control program. Available in two formulations: "Telvar" W; and "Telvar" DW, which is especially suited for light, sandy soils and in areas where annual rainfall is higher than 20 inches.

**"Ammate" kills more kinds of brush** and keeps it down longer than most weed and brush killers!

When the original spray job is well done, brush is kept under control with nothing more than an occasional spot spray later. You can rely on "Ammate" to do the job safely, even where your rights-of-way adjoin crop land, because "Ammate" is not volatile. There are no vapors to drift onto sensitive crops.

**FREE ILLUSTRATED BOOKLETS** describe how to control weeds and brush with Du Pont chemicals. For your copies, write to Du Pont, Grasselli Chemicals Dept., Rm. D 4038, Wilmington, Del. In Canada—Du Pont Company of Canada Limited, Montreal, Box 660, Canada.

**TELVAR®** Weed Killers — **AMMATE®** Weed and Brush Killer

*On all chemicals always follow directions for application. Where warning or caution statements on use of product are given, read them carefully.*

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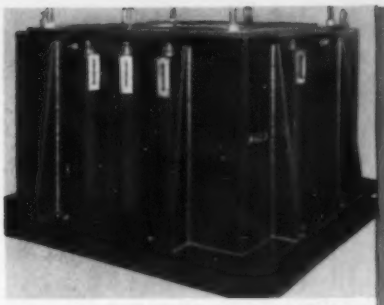
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

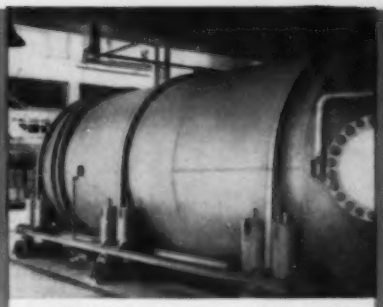
"Ammate," applied five years ago, is still keeping brush down along this right-of-way.

Maintenance crews prefer "Ammate" because they can use it without hazard to themselves, livestock, wildlife or adjoining crops.

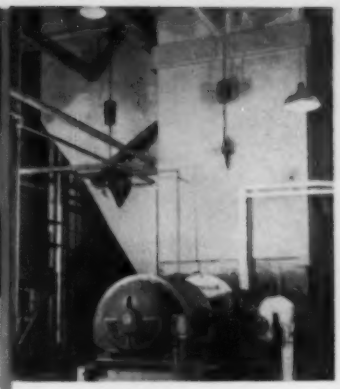
Same right-of-way as above, three years after treatment. Brush still under control; low-growing cover returned to resist erosion.



Base for supporting refinery tower, provided with Grinnell Spring Hangers for flexible support.



Grinnell Spring Hangers on large vessel of catalytic cracking unit in oil refinery.



Induced draft duct and blower in power station. Operates at about 500°F. Supported by Grinnell Spring Hangers.

## To support loads that won't stand still . . .

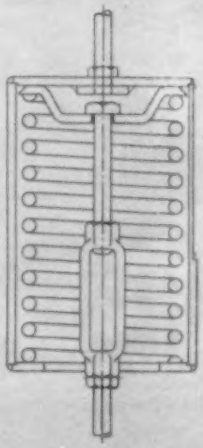
# GRINNELL PRE-ENGINEERED SPRING HANGERS

There are many industrial installations where heavy loads must be firmly, but flexibly, supported to keep them under control. Thermal expansion and contraction, of course, can move ponderous objects many inches. Shock and vibration, too, can make rigid support of heavy loads hazardous, due to possible serious trouble at terminals.

For installations such as these, more and more engineers are turning to *flexible* supports by Grinnell. Grinnell Variable Spring Hangers are *pre-engineered* to minimize changes in supporting force over total range of movement. Here are the important features that let these units turn in a star performance in a supporting role:

- Maximum variation in supporting force per ½" of deflection is 10½% of rated capacity — in all sizes.
- Precompression* assures operation of spring within its proper working range, as well as saving valuable erection time. Reduced over-all height saves space.
- Solid steel casing protects spring from damage and weather. Guides assure continuous alignment and concentric loading of spring.
- 18 sizes available from stock — load ranges from 53 lbs. to 12,000 lbs.
- Easy selection of proper sizes from simple capacity table.
- Installation is simplified by integral load scale and travel indicators.

*Precompression is a patented feature.



**VARIABLE SPRING HANGER FIG. B-268**

Fig. B-268, Type A, is designed for attachment to its supporting member by screwing a rod into a bushing in the top cap of the hanger. Adjustment of the hanger load is accomplished by turning the turnbuckle on the lower hanger rod until the hanger picks up the load and the load indicator points to the desired position. Six other types of attachment are available.

Grinnell Variable Spring Hangers are also available in half sizes (Fig. B-82); and in double spring sizes (Fig. B-98).

# GRINNELL

**AMERICA'S #1 SUPPLIER OF PIPE HANGERS AND SUPPLIES**

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
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**Note** / *Our long experience in working with both utilities and the public is your assurance of dependable work and good customer relations.*

# Bartlett scientists lead in tree research . . .

*First*
to introduce a complete, balanced shade tree food—"Bartlett's Green Tree Food"—and to devise feeding through holes in the ground.

*First*
to use power spray equipment for shade trees and to develop a practical method of reinforcing weak trees with eyebolts and cable process.

*First*
to produce a satisfactory flexible material for filling tree cavities. "Flexifil" has almost the same expansion coefficient as wood.

*First*
to introduce a special type of "Heal Collar" to expedite the growth of smooth, even new bark over the filler used in cavities.

*First*
to develop the "Invigorator Process"—sub-irrigation of shade trees with liquid food and conditioning chemicals under high pressure.

*First*
to maintain Tree Research Laboratories with a highly trained staff of nationally known scientists to study shade tree problems.

*First*
to successfully control one specific disease of trees by the use of chemicals introduced directly into the sapwood of the tree.

The list of "firsts" will never end at the Bartlett Tree Research Laboratories. Here, scientists are continually searching for new and better ways to protect the shade trees of America. When you consult your local Bartlett representative, you get the benefit of not only his local, native talent, but you also get the benefit of the combined scientific knowledge and long practice of a group including some of the leading authorities in tree health and protection. Small wonder those critical of results are turning to the Bartlett Way—the Scientific Way. Call the nearest Bartlett Office for a study of your tree situation.

The Bartlett Way

# BARTLETT TREE EXPERTS

Home Office, Research Laboratory and Experimental Grounds, Stamford, Conn.
Local Offices from Maine to the Carolinas, and West to Indiana.
See your Local Telephone Directory for Local Address.

# POWER UTILITY STEPS UP USEFUL AIR-TIME ONE-THIRD

**Albany district of Niagara-Mohawk Power Corporation is using General Electric all-electronic selective calling equipment to gain one-third more useful air-time in its 2-Way Radio system, according to Wesley Baylis, Niagara-Mohawk Communication engineer.**

THIS selective calling system permits the radio dispatcher to **(1)** call an individual driver in the normal manner, **(2)** automatically call him to the radio by audible means when he is working away from his vehicle, or **(3)** leave a call for him when he is out of audible range, by means of a signal light on the radio control unit, which remains lighted until he answers.

The dispatcher saves valuable air-time because he need not keep repeating a call for a driver who is away from his vehicle. He completes more calls faster. The saving of air-time, permitted by General Electric selective calling, also allows optimum use of 2-way radio on more vehicles than is normally possible.

Private conversations are carried on by Niagara-Mohawk between 12 dispatching points and any of 60 electric and gas service vehicles operating within a 60-mile radius of Albany, New York. Selective calling also eliminates most interfering calls from other utility radio systems, no matter how powerful their signals may become during freak atmospheric conditions.

* * *

**FOR ADDITIONAL INFORMATION** on G-E *all-electronic* selective calling equipment, write: *General Electric Co., Section X1925-7, Communication Equipment, Electronics Park, Syracuse, N. Y.*

**2. MASTER CONTROL** for Albany District of Niagara-Mohawk. Two dispatchers are used to coordinate radio calls to 60 vehicles of both gas and electric service departments. Calls from eleven remote control points are relayed through master controllers and one 50-watt G-E transmitter. Master controllers can contact any individual vehicle at any time through a General Electric selective calling system.

**1. ALWAYS AVAILABLE BY RADIO**...even with an air hammer going. The foreman of this gas service crew of Niagara-Mohawk can be called to the radio in his truck at any time. General Electric selective calling permits the master control dispatcher to automatically sound the vehicle's horn, which can be heard over the din of excavation work and traffic.

**3. REMOTE CONTROL** point in radio system of Niagara-Mohawk Albany District, which funnels calls through a master control and 50-watt transmitter to any individual gas or electric service vehicle.

*Progress Is Our Most Important Product*

GENERAL ELECTRIC

# TWO ANSWERS TO THE DEMAND FOR EASILY INSTALLED LOW-COST SWITCHING

## SS TYPE RU-1A or TYPE TR-1A

TENNESSEE — Typical of the installations by utilities from coast to coast is this one of Southern States Type TR-1A Disconnect Switches.

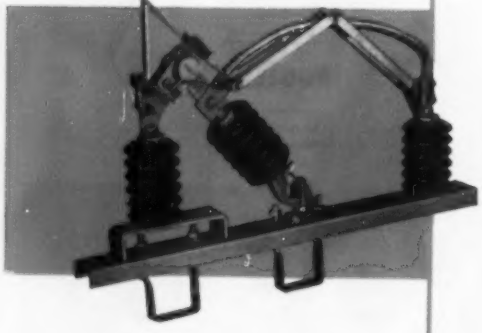
When easy, low-cost installation is the first requirement for disconnecting switches, Southern States offers you not one—but *two* complete lines from which to choose.

The Type TR-1A is a high-quality rocker-type disconnect that meets NEMA standards in every respect. It is available in voltage ratings from 7.5 kv through 69 kv and continuous current ratings of 200, 400, and 600 amps.

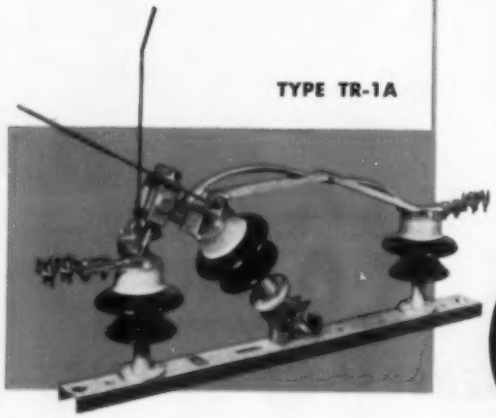
The Type RU-1A is a distribution level rocker-type switch specifically designed for pole-top mounting. Its dielectric strength is the same as standard levels for other distribution equipment, but it is below NEMA standards for power switching equipment. It is available in voltage ratings of 7.5 and 15 kv and continuous current ratings of 200 and 400 amps.

Both types are ruggedly constructed, and will provide reliable switching under all service conditions. Many utilities throughout the nation have found in these switches the answer to their needs for low-cost, easily installed rocker-type, vertical break disconnecting switches. So can you. Get full details in our Bulletins 54RU and 3050.

**TYPE RU-1A**



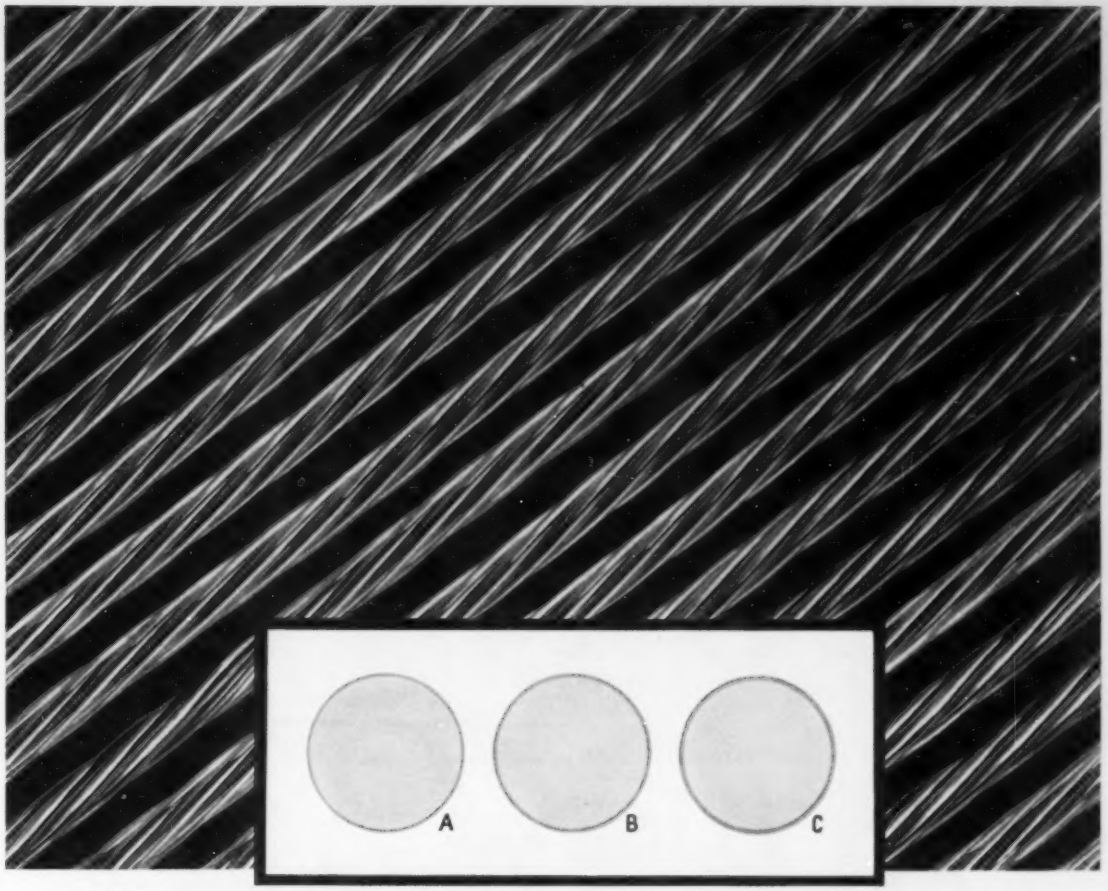
**TYPE TR-1A**



**EASY INSTALLATION**—One reason utilities find the installation of these switches so easy is the method for affixing the interphase shaft to the rocking insulator. (See photo) The shaft is laid in its proper position across all three phases and then only one bolt per phase is tightened to complete the installation, saving valuable installation time in the field.

**SOUTHERN STATES**
**EQUIPMENT CORP.**
HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto




# A Strand Coating for Every Field Condition

Nowadays the purchaser of strand is in a much better position than he used to be. He's not limited to a single zinc coating. If he needs the equivalent of extra-galvanized, he can get it. If he needs something twice or three times as thick, he can get it. For Bethlehem makes its bethanized strand with a *choice* of coating weights – A, B, and C – to meet the demands of different field conditions.

Remember the old days, when you settled for a light zinc coating, because there was nothing else to be had? Maybe it lasted as long as you wanted it to; more likely it didn't. But that's no longer a vexing problem. Now, from Bethlehem's A, B, and C bethanized coatings, you can obtain the one that exactly meets your needs.

The lightest, coating A, is the thickness of extra-galvanized. B is twice as thick as A; C three times as thick as A. All are zinc of 99.9 pct purity. All meet standard ASTM specifications.

In many cases the A-weight will do the job required; but B or C is often the better choice. Actually, these heavier grades cost very little more than the A, yet last much longer under parallel conditions.

You are invited to call our nearest office for full details. Our engineers will gladly give you complete information.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

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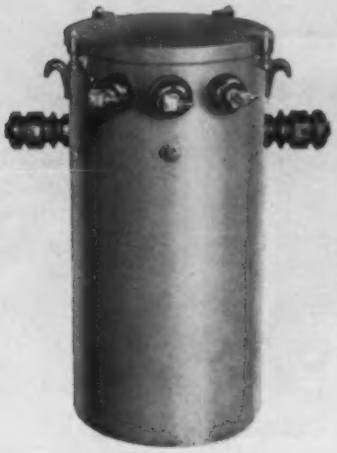
**BETHANIZED STRAND**

BETHLEHEM STEEL

● If transformer failure keeps your linemen busy removing distribution transformers and installing new ones, then it's time to investigate Standard Transformers as a solution to your problem. Once a Standard Distribution Transformer is installed on a line, it's there to stay . . . silently channeling current to your customers.

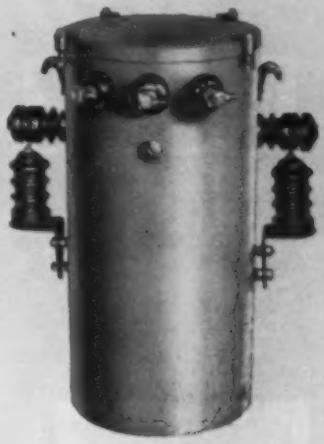
What makes Standard Distribution Transformers such dependable "watch dogs"? Close examination discloses sound, basic construction in full accordance with ASA and REA standards. Outstanding features set them apart from others as an indispensable and integral part of your distribution system. Covers are moisture-proofed with Neoprene gaskets which prevent oil leakage. They can be easily and quickly removed, allowing immediate access to vital parts. A rugged, copper-bearing steel tank houses the low-loss core assembly of non-aging, varnish-coated, silicon steel sheets. Specially designed core clamps hold core rigidly in place assuring quiet, trouble-free operation. These, plus numerous other construction features, demonstrate Standard Transformers to be helpful in solving your excessive maintenance problem.

Naturally, you want more information concerning Standard Distribution Transformers than that which we have presented in these limited words. Your nearby Standard Transformer representative has answers to your questions. Call him. Let him show you how Standard Distribution Transformers can help you maintain the excellent service your customers deserve.

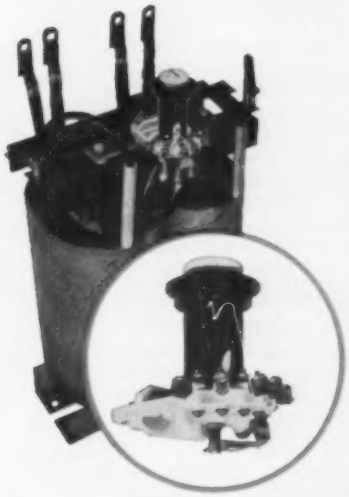


← Type A. OISC Conventional Distribution Transformer, 15 KVA, single phase, 60 cycle, with side wall mounted high voltage bushings. Standard construction for voltages 5 KV and sizes through 100 KVA.

→ Type CSP. OISC Distribution Transformer, 15 KVA, single phase, 60 cycle, with primary lightning arresters, internal fuses, low voltage circuit breaker and side wall mounted high voltage bushings. Standard construction for voltages 5 KV and less and sizes through 100 KVA.



# TRANSFORMERS ARE A
# YOUR DISTRIBUTION SYSTEM

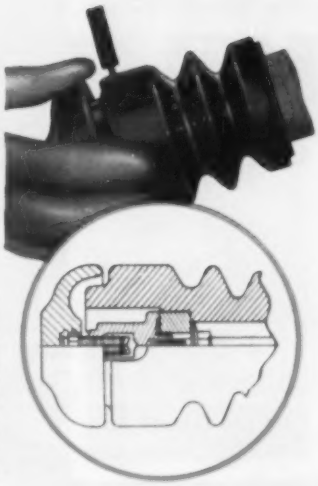


**NEW TANK WALL BUSHINGS →**

New bushings permit "flick-of-the-wrist" line insertion without tools. No live parts are exposed. Terminal compression stud keeps easy-to-grip, insulated porcelain cap from falling off when unscrewed to receive primary leads. Cables can be brought in from either side and held securely by pressure from the clamping shoe. Makes for faster, safer, easier installations.

**← TAP CHANGER SWITCH**

Standard's new Tap Changer Switch embodies a contact-making assembly with a brass wheel for positive contact. Normal settings are with 4-tap voltage section. 2½ % taps within 10 % range of normal rating. Standard supplies transformers with 4 taps above or below, or half above and half below as specified by the customer. This is available at no extra cost to you. Contact-making points are submerged in oil with the handle well above oil level.



Standard

**THE STANDARD TRANSFORMER COMPANY**

Trade Mark ®

**WARREN, OHIO**
**REPRESENTATIVES IN PRINCIPAL CITIES**

# P&K

PIONEER producer of the MODERN LOW-COST LIGHTING STANDARD AND BRACKET

P & K specialization, engineering and plant facilities have for years been devoted to the problem of how to achieve better lighting at lower cost . . . for streets and highways . . . for parking and recreational areas . . . for traffic signals . . . for shopping centers.

## WHEN YOU SEE:

- The seamless, tapered, high strength aluminum shaft . . .
- The patented, seamless elliptical all-aluminum arm . . .
- The strong, non-deteriorating "Aircomatic" weld . . .
- The clean, modern scroll-less bracket design . . .
- The smooth-surfaced, strong grain transformer, shoe and pedestal bases . . .
- The numerous shaft diameters and arm mounting heights . . .

## YOU KNOW:

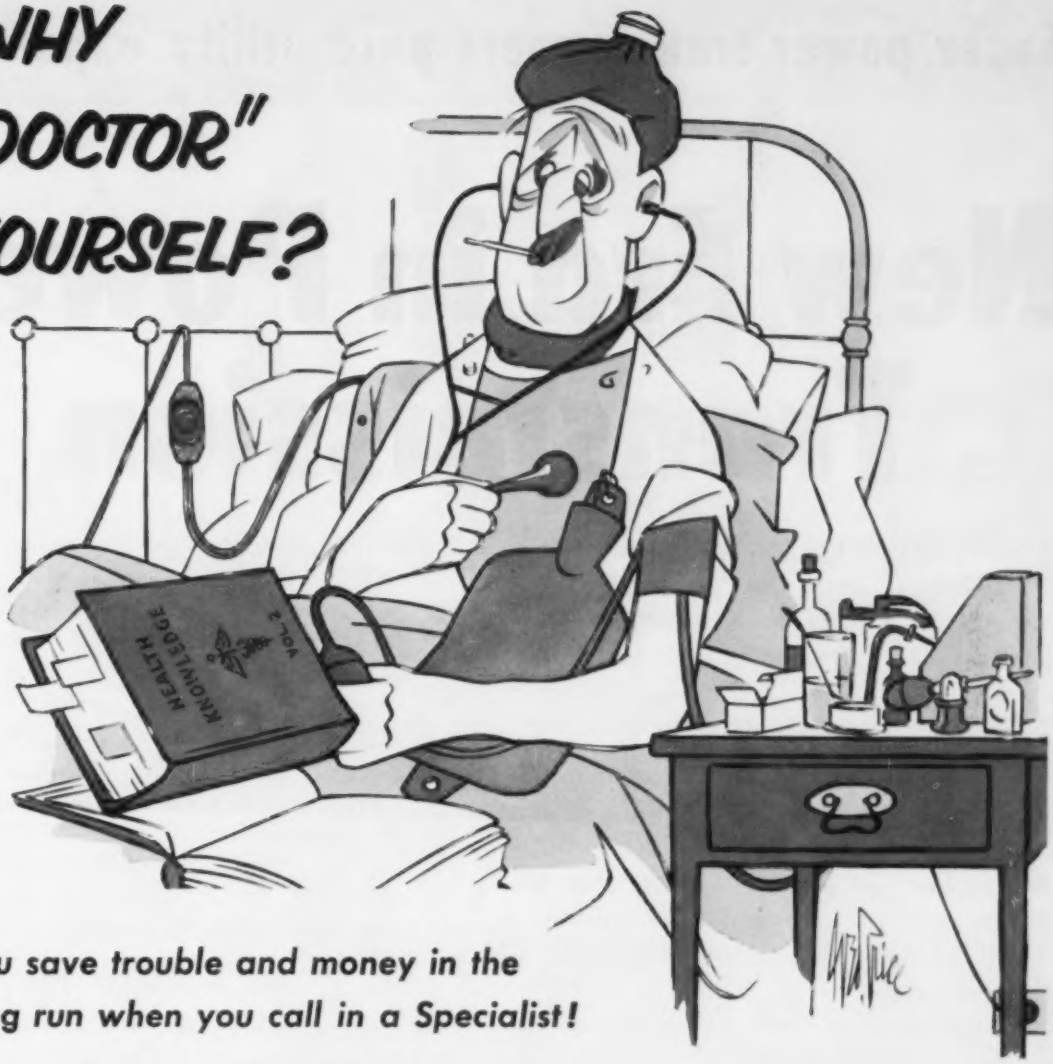
This is a P & K contribution to modern lighting at far lower cost. You know, too, that P & K costs *less to buy, less to install, and costs practically nothing to maintain!*

WRITE FOR THE LATEST P & K CATALOG . . . and use the planning and advisory services without obligation.

**Pfaff & Kendall**

84 Foundry Street
Newark 5, New Jersey

# WHY "DOCTOR" YOURSELF?




***You save trouble and money in the long run when you call in a Specialist!***

Prescribing lubricants for your complicated machines is, in a way, like prescribing medicine for yourself . . . a single mistake can be fatal. That's why it pays to call in a Specialist for consultation and advice when lubrication problems arise.

Socony-Vacuum has been serving industry for 89 years—far more than any other oil company. During this time we have built up a vast storehouse of lubrication knowledge and experience—have used this priceless information to develop top-quality oils and greases for every industrial need.

Working with you, we will apply this knowledge to diagnose your lubrication needs, prescribe the right oils and greases—install a program of Correct Lubrication. This cooperative effort will improve your production—reduce your maintenance costs.

Can you afford to accept anything less for your plant? Call your Socony-Vacuum representative.

**Socony-Vacuum**

SOCONY-VACUUM

*Correct Lubrication*

***FIRST STEP IN CUTTING COSTS***

SOCONY-VACUUM OIL COMPANY, INC., and Affiliates: MAGNOLIA PETROLEUM COMPANY, GENERAL PETROLEUM CORPORATION

## Super power transformers pace utility expansion

# New Era in Power Transmission

THIS 230,000-volt, 150,000-kva power transformer was built by Allis-Chalmers for Duke Power, to be installed at Riverbend steam station near Mt. Holly, North Carolina. It is believed to be the highest kva transformer ever put into service in the 230,000-volt class.

Records are being broken almost monthly as larger and larger power transformers are shipped by Allis-Chalmers to utility installations all over the country. For example, the highest voltage transformers ever ordered in the United States are now being built by Allis-Chalmers. These will be 345,000-volt, 200,000-kva single-phase units that will form the largest bank ever built — a total of 600,000 kva. They will be shipped at the end of this year.

Allis-Chalmers is becoming the overwhelming choice to help utilities break the barriers of high voltage transmission with larger and larger transformers. Here are some of the reasons why:

*Allis-Chalmers pioneered the development of corona-free design.* Result: Possibility of insulation damage that previously made such large transformers difficult to design is completely eliminated. Buyers are assured maximum transformer life with no danger that corona will cause insulation breakdown.

*Allis-Chalmers last year successfully produced the highest voltage commercial-type transformer ever built.* The 600,000-volt unit gives utilities a proved means for lifting voltage horizons even farther. It produced data which show the practicality of designs for power transformers for 880,000-volt transmission.

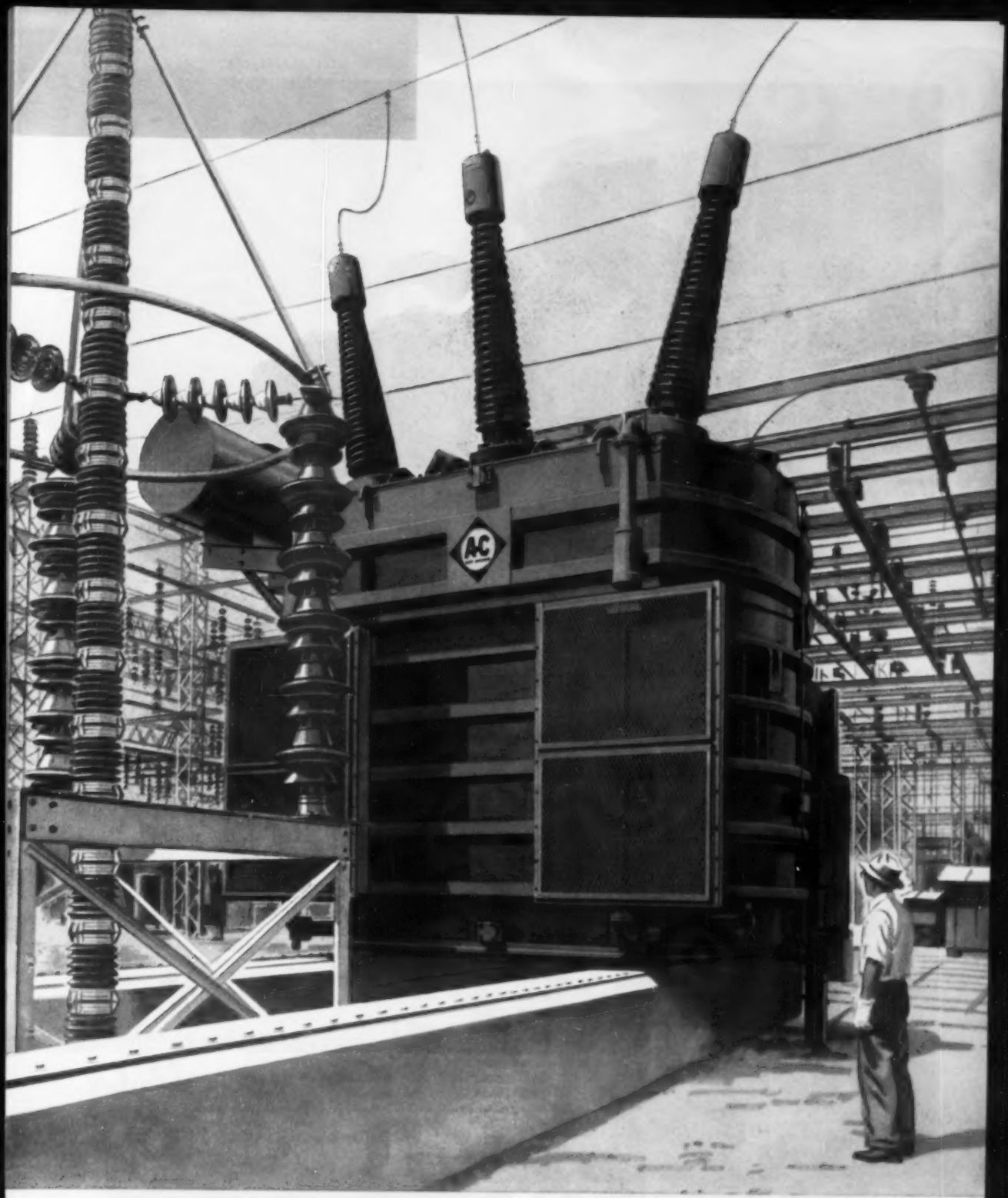
*Allis-Chalmers successfully adapted welding techniques to make possible the use of heavy plate aluminum in transformer core and coil construction.* As a result, transformers are lighter in weight, can be built in larger sizes, and can be more easily shipped and installed.

An Allis-Chalmers representative will be glad to discuss transformer developments with you at your convenience. Call the nearby A-C office or write Allis-Chalmers, Milwaukee 1, Wis.

A-4573

A-C ALLIS-CHALMERS

**ALLIS-**

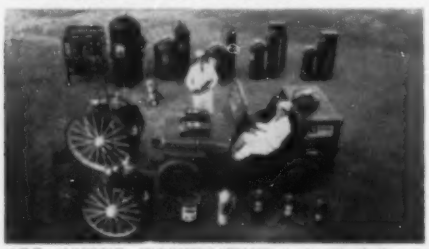


# CHALMERS

FIRE TRAINING SCHOOL. Here at Marinette your key plant personnel will receive special training in the proper use of every type of fire equipment. They will learn the basic techniques for fighting every kind of fire. This is the best equipped private fire training school in the nation.

# There is no need to accept less than Ansul's complete fire protection program!

TRAINING DEMONSTRATIONS. Our fire fighting experts provide training in the use of Ansul equipment at your plant.



ALL ANSUL EQUIPMENT is backed by a five year warranty, your assurance of fast, effective fire protection.

Experience can be a grim teacher. It has taught many a businessman that you need a *complete* fire protection program to guard against ruinous fire damage. You need *fast, effective equipment*, plus *trained personnel* to man that equipment. Ansul offers *both* and at no extra cost. Get in touch with the Ansul man, he has the story about *complete* fire protection.

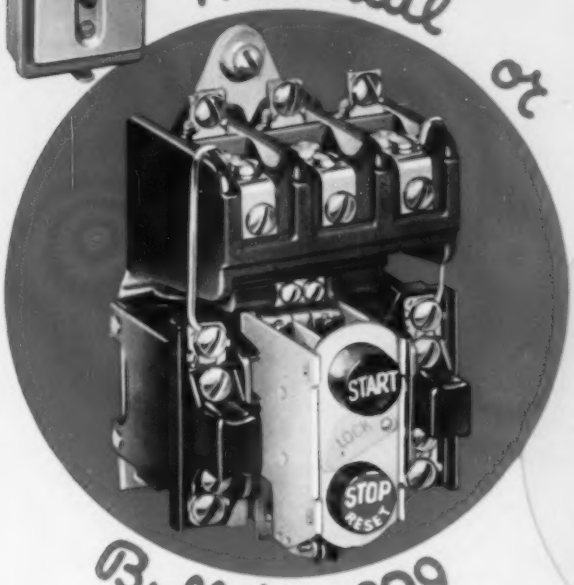
## Call the Ansul Man!

Get in touch with your local Ansul man through the "yellow pages" or write ANSUL CHEMICAL COMPANY, Dept. F-152, Fire Equipment Division, Marinette, Wisc. Write Ansul for your copy of new Fire Equipment Catalog.

ANSUL

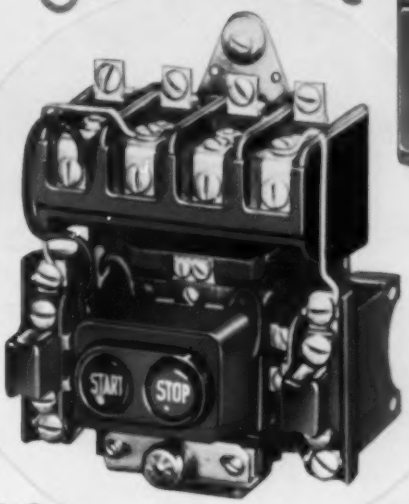
BULLETIN 609—
Max Rating: 5 hp,
220 v; 7½ hp,
440-550 v.

# Manual or Automatic




Bulletin 609

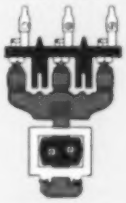
BULLETIN 709—
In 8 sizes up to 300 hp, 220 v; 600 hp, 440-550 v.




Bulletin 709—Form 1

CONTACTOR OPEN

CONTACTOR CLOSED



**DOUBLE BREAK, SILVER ALLOY CONTACTS**

The silver alloy used for Allen-Bradley double break contacts remains always in perfect working condition. Hence, there is no need for contact maintenance. You can install an A-B starter and forget it.

## The MOST POPULAR MOTOR STARTERS Trouble Free . . . No Contact Maintenance

These two Allen-Bradley across-the-line motor starters . . . Bulletin 609 manual and Bulletin 709 magnetic . . . enjoy world-wide popularity because no matter what the service may be, they will not fail.

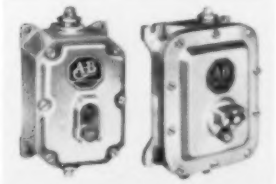
Both starters are simple, assuring long, trouble-free life. Both provide dependable overload protection to the motor. Both are push-button operated . . . one, mechanically through a snap-action linkage, and the other, electrically with a solenoid plunger.

For continuous plant operation, specify either Bulletin 609 manual or Bulletin 709 solenoid starters. For maximum protection to man, motor, and machine, the Bulletin 709 is best. Its "no-voltage" protective feature prevents accidental restarting of motors after power interruptions. Write for the A-B Handy Catalog —6th Edition.

Allen-Bradley Co.
1316 S. Second St., Milwaukee 4, Wis.

In Canada—
Allen-Bradley Canada Ltd., Galt, Ont.

**ENCLOSURES** for Every Operating Condition



NEMA type enclosures are available for Bulletin 609 and Bulletin 709 starters to satisfy any operating requirement.

# ALLEN-BRADLEY

MANUAL AND AUTOMATIC STARTERS

QUALITY

2-55-BM

# A QUALITY STARTING SWITCH for SMALL MOTORS

## *Providing Reliable Overload Protection*

With linkage lever & pilot light.

With standard lever & pilot light.

3-Way selector & pilot light.

With removable key switch.

NEMA Type 7 enclosure for hazardous dust or gas conditions.

NEMA Type 4 enclosure for watertight & weatherproof service.

# BULLETIN 600 MANUAL STARTER

## for Motors of 1 Hp or less

This compact toggle switch with a built-in overload breaker satisfies the National Electrical Code (Para. 4322 sub. C) covering overload protection requirements for motors of 1 hp or less.

QUICK MAKE & BREAK CONTACTS—The simple, rugged, over-center mechanism has a quick make and break action. No "teasing" of contacts means long contact life.

GENEROUS WIRING SPACE—Cover slips off, exposing front and both sides.

ATTRACTIVE APPEARANCE—The clean, modern lines are a sales asset to any machine. Enclosures listed for every service.

Allen-Bradley Co.
1316 S. Second St., Milwaukee 4, Wis.

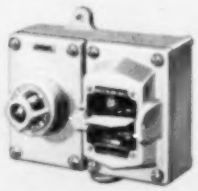
In Canada—
Allen-Bradley Canada Ltd., Galt, Ont.

**ALLEN-BRADLEY**
**TROUBLE FREE MOTOR CONTROL**
QUALITY

Flush mounting of two Bulletin 600 starters, each with a pilot light.

In a standard switch box.

In a surface mounted box.



NEMA Type 4 enclosure with pilot light for use in wet locations.

2-55-RM

# GUY-GRIPS COST LESS

# Here's Why

**PREFORMED "GUY-GRIPS"** are the fastest, most economical and most efficient means of dead-ending guys. They eliminate the need for clamps and ARE INSTALLED BY HAND. Since they cannot slip whether they are dead-ending a 2,000-pound, solid-wire guy or a 40,000-pound, ⅝" EHS steel guy, no retightening is ever necessary.

One large Utility has found that Preformed "Guy-Grips" save 50% on labor and 20% on material. Another assembles and installs a complete Preformed Guy Assembly (4 dead-ends) in the same time it used to take to assemble just one 3-bolt clamp.

**PREFORMED "GUY-GRIPS"** are proving definitely throughout the Country that they assure:

Maximum
- Corrosion Life
- Installed Tensile Strength
- Fatigue Characteristics
- Impact Strength
- Neatness in Appearance

Available in aluminum, copper, bronze (various grades including calsun), copperweld, stainless steel and galvanized steel, PREFORMED "GUY-GRIPS" assure the longest satisfactory guy life.

For complete details of their exclusive advantages, write, or telephone Cleveland: EXpress 1-3571.

**PREFORMED LINE PRODUCTS CO.**

**5349 ST. CLAIR AVE. • CLEVELAND 3, OHIO**

# "The Lower Temperature Rise of FUSETRON FUSES Solved a Serious Shutdown Problem for Us"

*J. F. Getz*
Chief Engineer,
University of Denver
Denver, Colorado

"The fine, new Field House we built in 1949 included an ice skating rink. The ice making equipment uses two 3 phase, 220 volt, 100 hp., compressor motors having a running current of 246 amperes.

"Ahead of the magnetic starters for these motors were two 400 ampere safety switches originally equipped with 400 ampere renewable fuses.

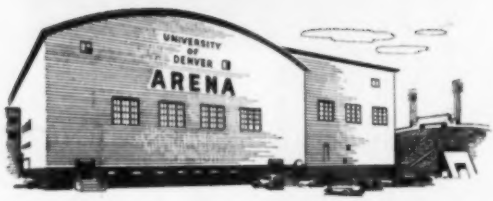
"Shortly after the compressors went into service heat began developing in the safety switches. The fuses were running very hot — in fact to such a degree that the links in the fuses were melting and causing as many as three shutdowns a week.

"In August of 1951 I saw a demonstration by a BUSS representative that showed how much cooler was the operating temperature of Fusetron fuses.

"Right then, I determined to try out Fusetron fuses in these two switches. To get better protection I dropped the fuse size down to 300 amperes.

"With the installation of Fusetron fuses the heating immediately disappeared and so did the shutdowns it formerly caused.

"The lower temperature rise of Fusetron fuses solved a serious shutdown problem for us."




**YOU TOO, CAN MINIMIZE PLANT SHUTDOWNS AND EQUIPMENT LOSSES BY INSTALLING FUSETRON FUSES — THEY GIVE 10 POINT PROTECTION**

**1** Protect against short-circuits. **2** Protect against needless blows caused by harmless overloads. **3** Protect against needless blows caused by excessive heating — lesser resistance results in cooler operation. **4** Provide thermal protection — for panels and switches against damage from heating due to poor contact. **5** Protect motors against burnout from overloading. **6** Protect motors against burnout due to single phasing. **7** Give DOUBLE burnout protection to large motors — without extra cost. **8** Make protection of small motors simple and inexpensive. **9** Protect against waste of space and money — permit use of proper size switches and panels. **10** Protect coils, transformers and solenoids against burnout.

# And with FUSETRON FUSES you have Greater Safety, because of their 100,000 amp., Interrupting Capacity Rating

Tests verified by the Electrical Testing Laboratories of New York show that Fusetron fuses, on loads under 600 amperes, can interrupt safely the most severe available short circuit currents.

The test circuits were set to deliver far in excess of 100,000 amperes — yet the 250 and 600 volt Fusetron fuses on each and every test cleared the circuit without igniting readily flammable material placed around the fuses . . . and there was comparatively little noise.

***You get all this added safety for every set of fuse clips in your plant without changing a panelboard or switch***

**No Interference with time-lag**

Fusetron fuses' time-current characteristic, of the utmost importance to give proper motor and electrical protection and to eliminate needless blows, has in no way been disturbed.

**Maximum Safety**

With Fusetron fuses there is no cascading of interrupting rating — no places where an excessive fault current might cause serious damage. Every Fusetron fuse has an interrupting rating in excess of 100,000 amperes.

You don't have to worry about selecting chosen spots in which to pay extra for "safe" equipment. Wherever a Fusetron fuse is installed you have safety as sure and dependable as you can buy — no matter what you pay.

**No Maintenance Costs**

Once properly installed Fusetron fuses are maintenance free. They require no costly inspection or down-time for calibration and other maintenance necessary on mechanically operated devices.

Dust, fumes, corrosion or age cannot prevent a Fusetron fuse from opening safely. There are no hinges, pivots or contacts to stick or slow down the operation of the fuse on short-circuit.

**No Recalibration Costs**

When a Fusetron fuse does blow, there is no recalibration needed. As quickly as the fault in the circuit is corrected, you slip in a new fuse that has been CALIBRATED AT THE FACTORY BY ENGINEERS — a fuse that is as safe and dependable as the one that blew.

***For High Interrupting Capacity above 600 and up to 5000 amps. — Install BUSS Hi-Cap Fuses***

BUSS Hi-Cap fuses offer unlimited interrupting capacity for circuits of 600 volts or less. Their high speed operation on heavy shorts limits current to safe values. This minimizes damage to equipment and cuts down dangerous stresses on transformers.

When coordinated properly with Fusetron fuses they will not open ahead of the fuse nearest to the fault—thus the trouble is isolated to the part of the circuit in which the fault occurs.

**Added Safety on Old Installations**

On installations where the increase in the capacity of the circuit has outgrown the interrupting rating of the circuit breakers, BUSS Hi-Cap fuses offer a safe and relatively inexpensive way to protect inadequate breakers against rupture in event of a bad fault.

***PLAY SAFE—Install FUSETRON Dual-Element Fuses and BUSS Hi-Cap Fuses throughout the entire electrical system . . . Today!***

One needless shutdown . . . one lost motor . . . one destroyed switch or panel . . . one burned out solenoid . . . may cost you far more than replacing every ordinary fuse with a Fusetron fuse on loads up to 600 amps — and BUSS Hi-Cap fuses on loads above that.

Blowing time charts and more information are available. Write for bulletins FIS and HCS.

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

BUSSMANN Mfg. Co.
(Division of McGraw Electric Co.)
University at Jefferson, St. Louis 7, Mo.

Please send me complete facts about FUSETRON dual-element Fuses and BUSS Hi-Cap Fuses.

Name_____

Title_____

Company_____

Address_____

City & Zone_____ State_____ EW2-7-55

# What they say...

## about SORGEL air-cooled dry-type transformers

"The unique arrangement for entering conduits and roomy connection compartment saved us money."

"We needed a quiet transformer, so we selected SORGEL."

"We like the way the 50 Kva is equipped with wall brackets. With another make we had to make special brackets at extra expense."

"When we turned on the current we were amazed at how quiet it was."

"The solderless terminals save money."

"Upon checking the reason for the circuit breaker going out frequently, we found that the transformer was carrying overloads up to 25% at times, and showed no signs of over-heating."

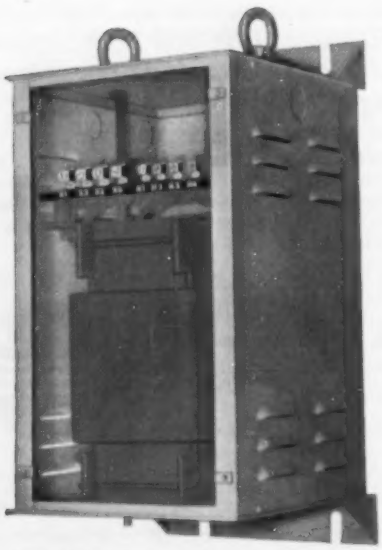
"It gets the job done where others do not."

"With the 'Underwriters' label on SORGEL transformers, there is no question from inspectors."

"We have enjoyed nice sales on this transformer — for one reason — QUALITY."

*— and many more praises and compliments from appreciative customers. You, too, will be well repaid by investigating the reasons for the ever-increasing preference for SORGEL transformers.*

7½ Kva single phase



50 Kva wall mounting transformer, with front panel removed, showing roomy connection compartment and solderless terminals.

**Complete Line**

¼ Kva to 1500 Kva single phase.

1 Kva to 3000 Kva 3-phase, 2-phase, and phase changing.

All standard voltages, such as 120, 208, 240, 480, 600, 2400, 4160, 4800, 7200, 13,200, and up to 15,000 volts, and any intermediate or special low-or voltage.

**Stock carried by jobbers in the following cities:**

Milwaukee, Wis. — Roxbury, Mass.
Chicago, Ill. — Cleveland, Ohio
Rock Island, Ill. — Louisville, Ky.
Rockford, Ill. — Omaha, Neb.
Richmond, Ind. — Davenport, Iowa
New York, N.Y. — Cedar Rapids, Iowa
Buffalo, N.Y. — Beaumont, Tex.
Los Angeles, Calif.

**Also Special Transformers and Saturable Reactors**

**Consult the classified section of your phone directory, or write to the factory**

## SORGEL ELECTRIC CO.

834 West National Ave.
Milwaukee 4, Wisconsin

***40 years experience in the development, manufacturing and application of transformers***

*Another reason why*
UTILITIES EXPECT MORE FROM POWERS *American*

# The Ultimate in Line Construction Equipment

**MANAGEMENT**
likes the 800-C because it saves man-hours—furnishes crew comfort—provides a safe, durable, low-upkeep unit for heavy work.

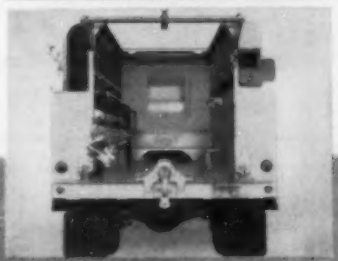
**SUPERVISORS**
like the 800-C because it's a completely equipped body that's easy to load—easy to use—easy to inventory.

**CREW MEMBERS**
like the 800-C because it keeps tools and supplies in easy-to-find order. And, with a Pole-Master, it's a lineman's dream.

All shelves and parts bins are standard equipment. Street-side doors open 180° for easy access to all compartment space.

Sliding drawers are furnished in curb-side compartments. All door locks are keyed alike. Crew enclosure seats four.

56" wide cargo area provides space for miscellaneous supplies. The body can be equipped to meet individual needs.



Utility operators indicate that the 800-C is destined to set a new standard for line construction vehicles.

It furnishes the storage space—the crew facilities—and the equipment for handling the most rugged types of routine or emergency line work. And, when equipped with a *Pole-Master* fully-powered, live-boom derrick—as shown above—crews can set poles up to 75 ft. in length.

The Series 800-C in 11′, 12′3″, and 13′ lengths—and the Series 800 (without crew enclosure) in 11′ or 12′6″ lengths—can be furnished with *Pole-Master* or conventional derrick.

**COMPLETE DETAILS** and prices are yours for the asking.

*Powers-American Division*

**McCABE-POWERS AUTO BODY COMPANY**

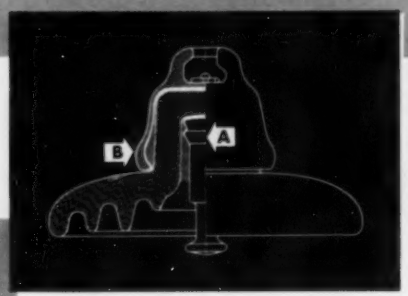
5988 NO. BROADWAY • ST. LOUIS 15, MO. 625 CEDAR STREET • BERKELEY 10, CALIF.

# PINCO PRODUCES ITS 10,000,000th SUSPENSION UNIT

**Since 1921, Pinco Suspension Insulators have rolled up an impressive record of 50,000,000 SERVICE YEARS without replacement due to electrical or mechanical failure.**

Just recently, the 10,000,000th Pinco Suspension Insulator came off the production line. And because, from the first, the basic design has been *exactly right*, the famous Pinco Corset Cap and the Two-Step Pin today are accepted everywhere. And Pinco has kept ahead of industry needs with heavier, more rugged porcelain bodies, designed and built to meet future line requirements.

Yes, Pinco design has proved its perfection under the toughest laboratory tests and under every condition of actual service. So for "right-on-the-job" performance, lower maintenance costs, longer line-life . . . *put up Pinco* TO BE SURE!




*The Pinco 1060 Insulator conforms to EEI-NEMA Standards 52-3*

*Because they have been proved "right-for-the-job," The Pinco Two-Step Pin (A) and the Pinco Corset Cap (B) of identical design are used in all Pinco Suspension Insulators, from the 1510 (rated at 10,000 lbs.) to the 1500 (rated at 25,000 lbs.) . . . proving again that Pinco is* right *from the start!*

*For complete mechanical and electrical specifications covering Pinco Suspension Insulators, refer to Pinco Catalog No. 49, Pages 62-73, or contact The Joslyn Mfg. & Supply Co. office in your locality.*

PINCO INSULATORS

1920 35 1955 YEARS OF SERVICE TO THE ELECTRICAL INDUSTRY

**The Porcelain Insulator Corporation**

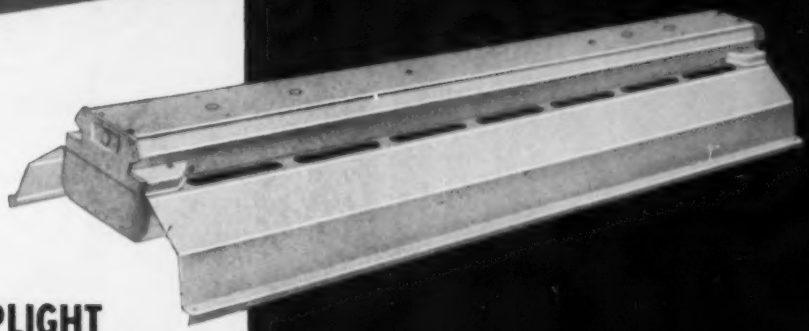
LIMA, N. Y.

*Suspension Insulators . . . Clamps and Fittings . . .*
*Switch and Bus Insulators . . .*
*Distribution and High Voltage Pin Types . . .*
*Guy and Tree Insulators . . . Special Porcelain.*

# *Wheeler* "D" LINE

## the "NEW LOOK" in INDUSTRIAL LIGHTING

**New design features for better seeing.**



**1 MORE UPLIGHT**

to reduce contrast for seeing comfort. Exceeds new RLM Standards.

**2 MORE EFFICIENCY**

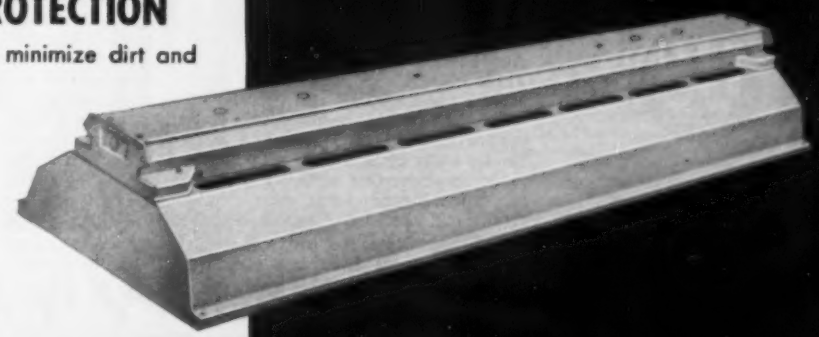
to start with and higher maintained efficiency due to self cleaning features.

**3 MORE PROTECTION**

for lamp holders to minimize dirt and moisture problems.

**PLUS**

all the extra quality features that have distinguished Wheeler lighting fixtures since 1881.



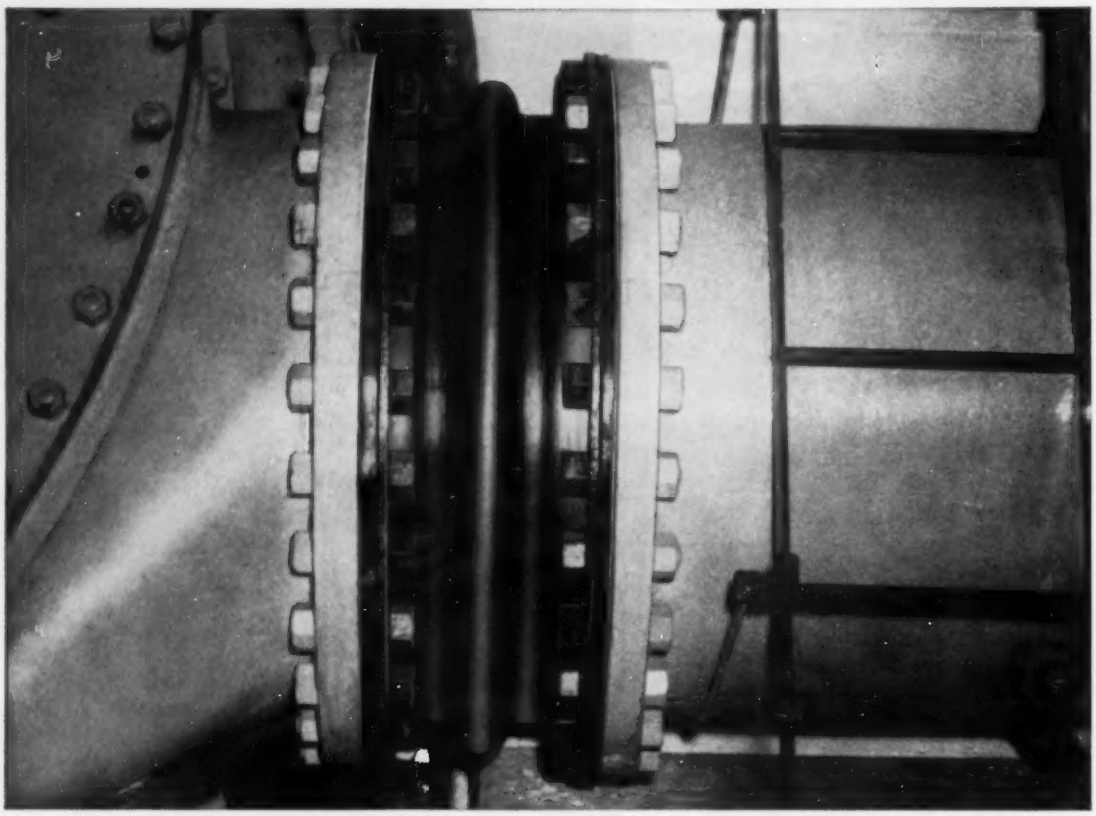
*Wheeler* **REFLECTOR COMPANY**

Distributed Exclusively through Electrical Wholesalers

WHEELER

215 CONGRESS STREET, BOSTON 10, MASSACHUSETTS

# 28 years old... but there's a lot of life in the old joint!



*"U.S." Research perfects it*
*"U.S." Production builds it*
*U.S. Industry depends on it*

Back in 1926, this 30" x 12" U.S. Expansion Joint was installed in a Louisiana power plant. This rubber joint is still in fine working condition. Age has not impaired its efficiency. Three other U.S. Joints in this plant are the same age, are still performing well... and one of them has been used continuously in the valve end inlet header water circulation line in a *very moist location.* Our service engineers report it has many more years of fine service still ahead!

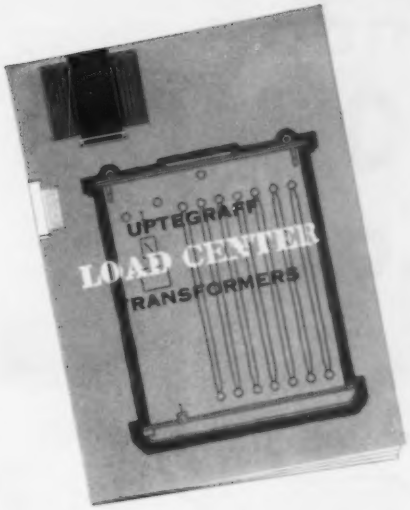
In United States Rubber Company's Expansion Joint Line are standard types to meet the majority of general industrial requirements on pressure or vacuum lines—insulating against vibration, compensating for expansion or contraction. Joints can also be designed and built to meet your own specifications. You can always rely on U.S. Expansion Joints to lengthen the life of equipment, save many times their original cost.

Get in touch with any of United States Rubber Company's 27 strategically located District Sales Offices, each staffed with engineers to serve you, or write to address below.

**UNITED STATES RUBBER COMPANY**

**MECHANICAL GOODS DIVISION · ROCKEFELLER CENTER, NEW YORK 20, N. Y.**

**Hose • Belting • Expansion Joints • Rubber-to-metal Products • Oil Field Specialties • Plastic Pipe and Fittings • Grinding Wheels • Packings • Tapes Molded and Extruded Rubber and Plastic Products • Protective Linings and Coatings • Conductive Rubber • Adhesives • Roll Coverings • Mats and Matting**



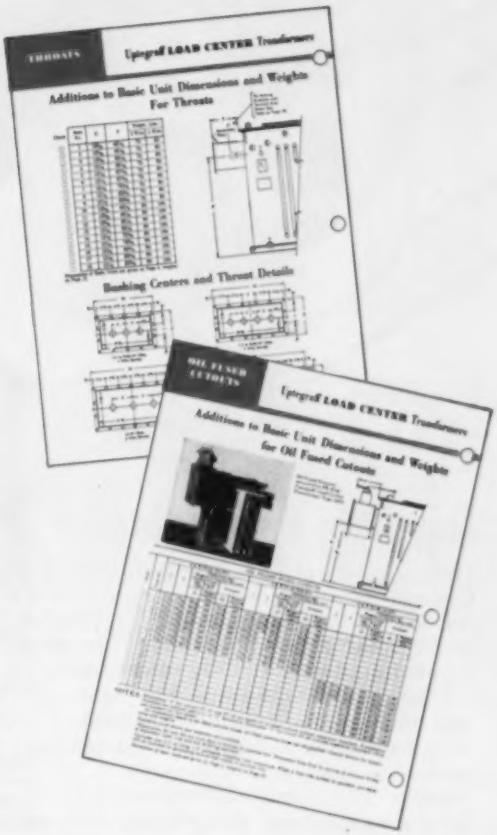

# Uptegraff Announces a complete series of

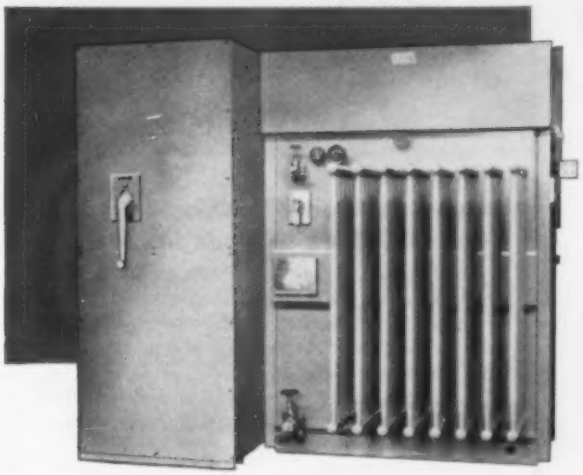
# LOAD CENTER TRANSFORMERS

**(150-2500 KVA)**

Uptegraff announces a new series of *Liquid Filled* Load Center Transformers, made in eighteen ratings, from 150 to 2500 KVA., 3-phase. Designs are based upon extensive experience with this type of transformer, and represent modern engineering and manufacturing practice.

To simplify the selection and arrangement of auxiliary equipment, we have prepared a unique brochure, some pages of which are shown here. With this brochure, you can readily determine overall dimensions, total weights and other information for any combination of the Basic Transformer Unit with various types of switches and accessories. A check system permits the easy and accurate locating of desired data pertaining to various arrangements of properly rated equipment for any selected basic unit. We will be glad to send you a copy, free.


THROATS
Uptegraff LOAD CENTER Transformers
Additions to Basic Unit Dimensions and Weights For Throats
Bushing Centers and Throat Details
OIL FUSED CUTOUTS
Uptegraff LOAD CENTER Transformers
Additions to Basic Unit Dimensions and Weights for Oil Fused Cutouts



## R. E. Uptegraff Manufacturing Co.
## Scottdale, Pennsylvania

**Send** for a free copy of this 20-page data book, giving important and useful information on Uptegraff Load Center Transformers. Fill out and mail the coupon below.

R. E. Uptegraff Manufacturing Company
Scottdale, Pennsylvania

Please send a copy of your LOAD CENTER TRANSFORMER brochure, Catalog 132, to:

Name _____ Position _____

Company _____

Address _____

EW-2

# This Oval Window Holds Two 500 MCM Insulated Cables

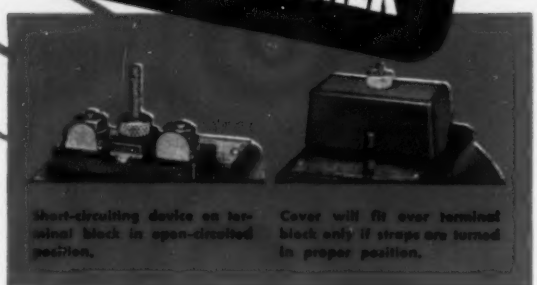
## Get it in any rating!

**There is plenty of room for conductors** in Allis-Chalmers 600-volt outdoor-indoor current transformers. Every rating has this same big oval window 1⅜ by 2¾ inches — large enough to hold two 500 MCM stranded conductors with 600-volt insulation.

In addition, units are compact and lightweight. Install them singly or in multiple, in standard instrument transformer enclosures or outdoors. You can mount them in any position — they have special provision for different methods of mounting. It is possible to get a number of ratings from a single unit by passing primary conductor through window more than once. Type TWM transformers come in the following ratings: 200 to 5 amp, 400 to 5 amp, 600 to 5 amp, and 800 to 5 amp.

Get all the facts. Ask your nearby A-C office for a copy of 61B8080 or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4548



Short-circuiting device on terminal block in open-circuited position.

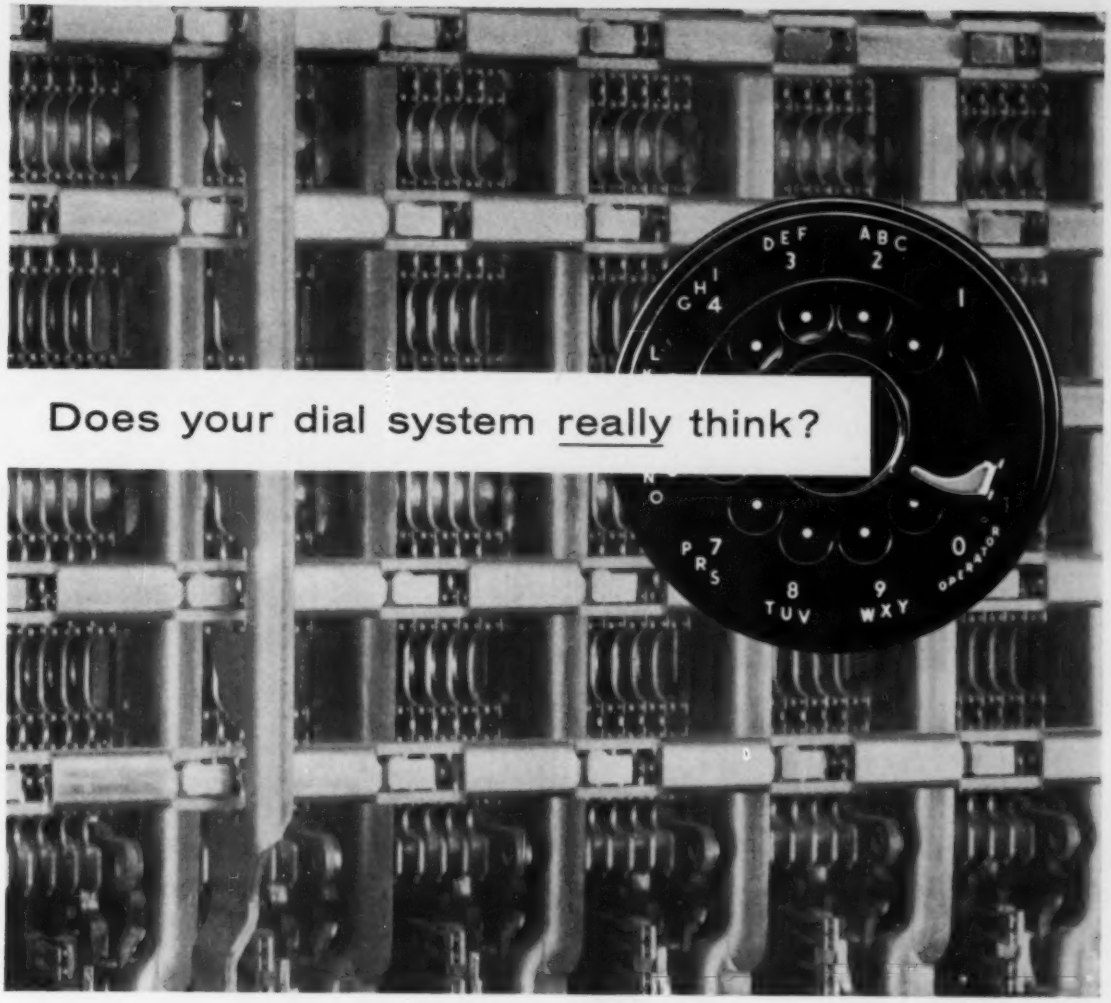
Cover will fit over terminal block only if straps are turned in proper position.

### Removable Short-Circuiting Device... Can be Added to Units in Service

A useful operating option has been added to Allis-Chalmers thru-type current transformers. A short-circuiting device fits the secondary terminal block: with straps turned to short-circuiting position, cover cannot be replaced. Device is supplied on all units, can easily be removed if desired. It is readily adaptable to any transformer in service.

A-C ALLIS-CHALMERS

# ALLIS-CHALMERS




Part of the control equipment of a modern dial system—dial telephony's equivalent of a brain. It goes into action the instant you dial a call, selecting the telephone you want to reach and directing the switches that set up the connection . . . just as the brain directs the muscular actions of the body.

This question can't be answered until we learn more about the nature of thought. But dial telephone systems *do* simulate many of the processes of the human brain. For example, when a number is dialed, Bell's newest switching system—

**COUNTS** the dial pulses

**REMEMBERS** them

**DECIDES ON** the best route to a nearby town or across the nation

**TESTS** to see if the route is clear

**SELECTS** an alternate if the first route is busy

**REPORTS** difficulties in circuits, if any

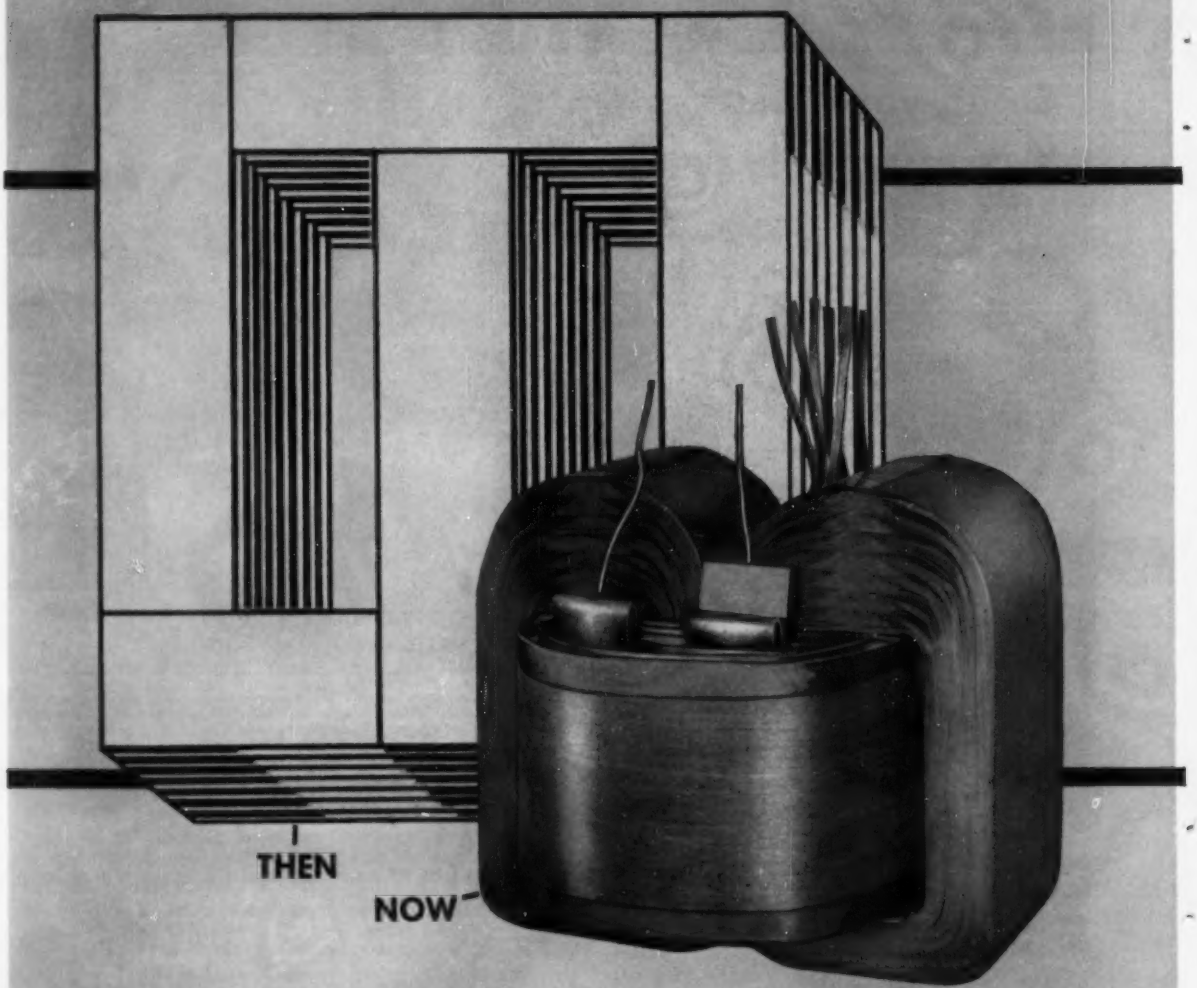
Today's automatic switching reflects the creative thinking of many scientists and engineers at Bell Telephone Laboratories. Each year your dial telephone is able to do more for you. And this is but one phase of the continuing effort to keep your Bell telephone service the world's best.

**BELL TELEPHONE LABORATORIES**

IMPROVING TELEPHONE SERVICE FOR AMERICA PROVIDES CAREERS FOR CREATIVE MEN IN SCIENTIFIC AND TECHNICAL FIELDS

# the KUHLMAN BENT IRON CORE...

THE SMALLER, THE LIGHTER, THE REVOLUTIONARY CORE



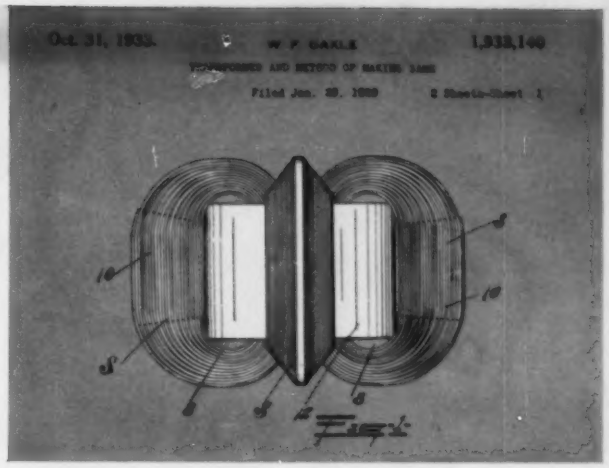

# KUHLMAN

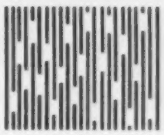
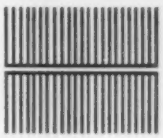
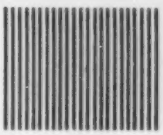
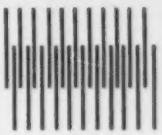
**KUHLMAN ELECTRIC COMPANY**
BAY CITY, MICHIGAN, CRYSTAL SPRINGS, MISSISSIPPI, SALINAS, CALIFORNIA

# "an industry first"

## Patent #1,933,140 revolutionized core design

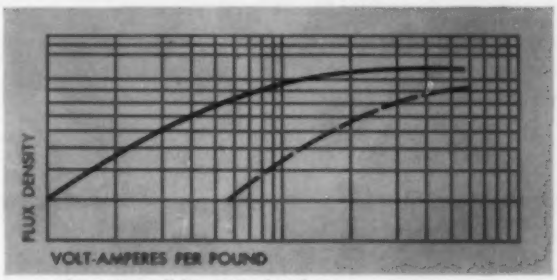
In 1933 Kuhlman was granted Patent #1,933,140 (application filed 1/29/29) on the radically different Bent Iron Core and by 1935 the new core was the first and only core of its kind on the market. The Bent Iron Core not only gained the electrical industries' unanimous acceptance but precipitated a revolution in transformer design, and today, through the use of better materials and improved manufacturing processes, the Kuhlman Core still retains its leadership over other types of cores. Compare the outstanding advantages of the Bent Iron Core's principle of lapped joint construction with other methods of core construction.




| CORE CONSTRUCTION FEATURES |  A |  B |  C |  KUHLMAN |
|---|---|---|---|---|
| Flux density in joint area of core | High | Normal | — | Low |
| Core loss reduced in joint area of core | no | no | — | yes |
| Exciting current reduced in joint area | no | no | — | yes |
| Assembly of core after anneal prevents possibility of adhesions between laminations with resulting increase in core loss | yes | no | no | yes |
| Good space factor — windings in core window | yes | yes | no | yes |
| Extra copper in windings required by poor space factor | no | no | yes | no |
| Efficient design with no increase in over-all weights and dimensions | no | no | no | yes |

## Kuhlman Distribution Transformers are smaller and lighter

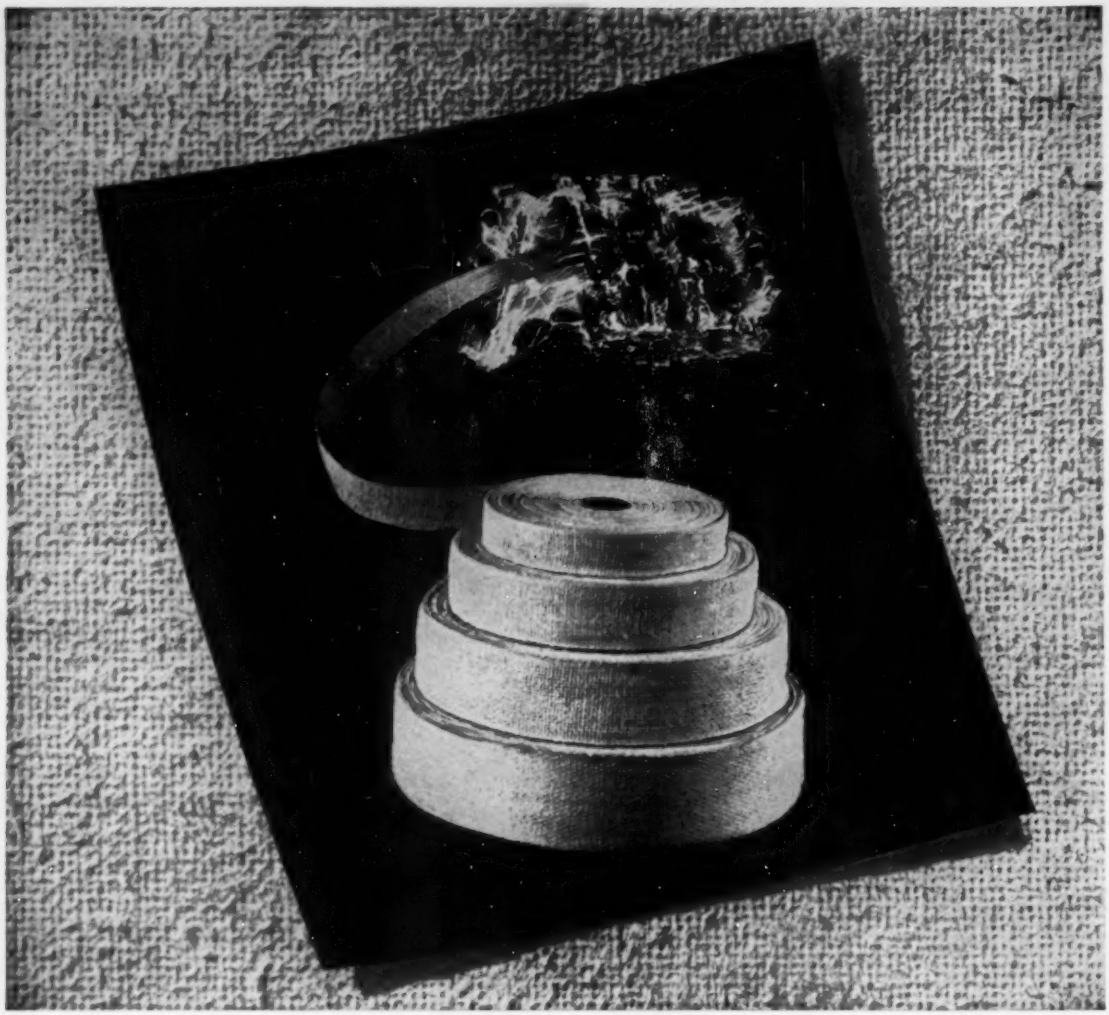
The cold rolled oriented silicon steel used in the Bent Iron Core permits the flux path to follow the grain of the steel resulting in a higher flux carrying capacity and a smaller, lighter core. Less copper is needed in the windings, thus reducing the size and weight of the coil. The smaller tank made possible by the Bent Iron Core and coil assembly makes Kuhlman Distribution Transformers easier and less expensive to handle, saves both storage and pole space, and permits the installation of higher KVA on poles.




——— Flux path parallel to grain of steel.
— — — Flux path transverse to grain of steel.

## To get Bent Iron Core features order KUHLMAN Distribution Transformers

164



## Specify K&M asbestos textiles for the highest quality and dependable performance

Asbestos, a product of nature, is the only inorganic mineral fiber which can be carded, spun and made into textiles.

Keasbey & Mattison Asbestos textiles are made with only the finest grades of asbestos fiber. They're known for their uniformity of weave and thickness. That's why the electrical industry—manufacturers, contractors and central stations—has come to rely on K&M Asbestos textiles.

K&M Asbestos textiles are available in many different forms . . . roving, yarn, thread, tapes, cloth, tubing, wick packing, twisted and braided rope packing, and safety garments. All of these textiles are made with the greatest care for maximum uniformity and fidelity to specifications.

Be sure to contact K&M for the answer to your insulating problem. Remember that K&M has more than half a century of research and development experience, backing up these high quality asbestos textiles. Write for complete information today.

**KEASBEY & MATTISON** COMPANY • AMBLER • PENNSYLVANIA

IN CANADA: ATLAS ASBESTOS COMPANY, LTD., MONTREAL, TORONTO, WINNIPEG, VANCOUVER

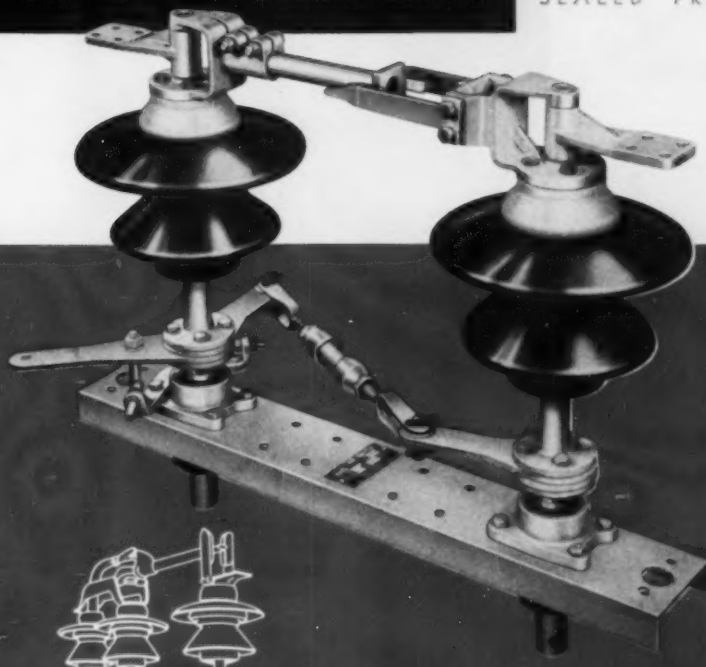
*Nature made asbestos . . . Keasbey & Mattison has made it serve mankind since 1873*

The new member of the R&IE Switch family... Type **DR** features the...

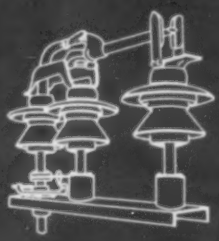
# SPHC

SEALED PRESSURE HINGE CONTACT

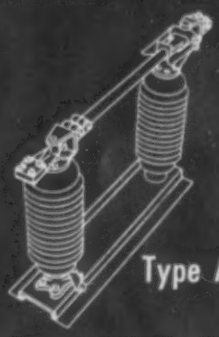
*an exclusive R&IE feature*



Completing the family of Group Operated Outdoor Switches . . .



Type TTR49



Type A6

## *Check the Facts*

1 **HINGE**—Sealed Pressure Hinge Contacts used are identical in construction to those featured on vertical break type TTR49 and horizontal break Type A switches. The "sealed in", helical type flexless contact improves operating and thermal characteristics of the swivel joint at both hinge and jaw.

2 **JAW CONTACTS**—Hi-Pressure, Hi-Thermal capacity, silver-to-copper wiping contact. The construction is identical to that of the vertical break Type TTR49 and horizontal break Type A. A combination of current carrying metals, each especially suitable for its particular function,—now featured on all R&IE group operated switches.

3 **TERMINALS**—Both at same elevation from base. Clamp type, with four half-inch bolts on 1¾ inch centers, especially suitable for R&IE Type UC universal, or Type TL clamps, or any NEMA standard 400, 600 or 1200 ampere clamping.

Tinned surfaces can be provided for aluminum conductor.

4 **BLADE**—Extra heavy, tubular hard-drawn copper blade with brazed-on contact block which makes the best outdoor switch contact for all service conditions when engaged with the silver surface of the jaw.

**R&IE SWITCHING EQUIPMENT**

DIVISION OF I-T-E CIRCUIT BREAKER CO.

GREENSBURG, PA.

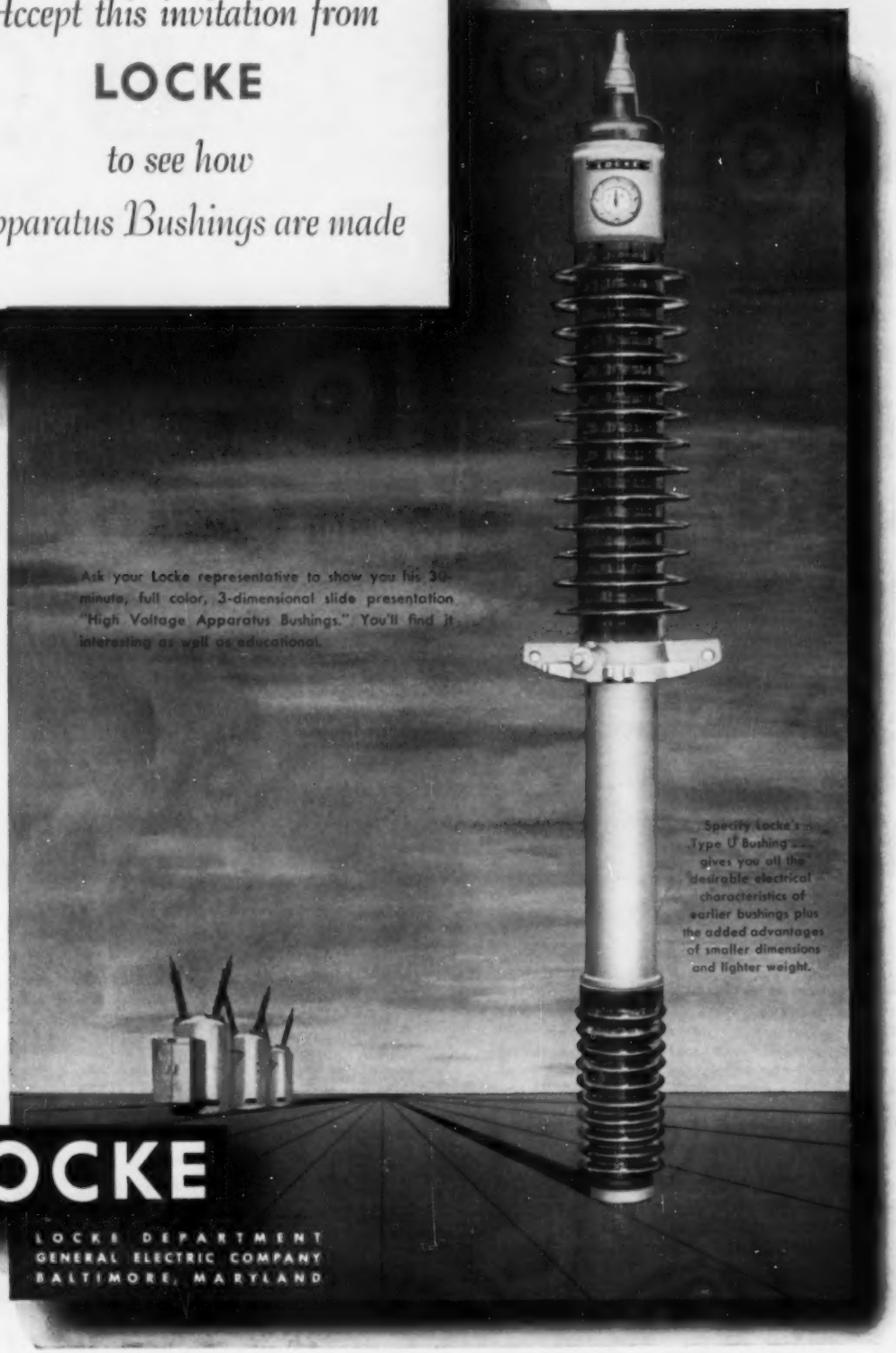
INDOOR BUS SUPPORTS and BUS FABRICATION • OUTDOOR BUS SUPPORTS and AIR SWITCHES • SUBSTATION STRUCTURES—Steel, Al-Fe, Aluminum • TESTING DEVICES • KIRK KEY INTERLOCK SYSTEMS • ISOLATED PHASE BUS STRUCTURES • INTERRUPTER SWITCHES

*Accept this invitation from*

**LOCKE**

*to see how*

*Apparatus Bushings are made*


Ask your Locke representative to show you his 30-minute, full color, 3-dimensional slide presentation "High Voltage Apparatus Bushings." You'll find it interesting as well as educational.
Specify Locke's Type U Bushing ... gives you all the desirable electrical characteristics of earlier bushings plus the added advantages of smaller dimensions and lighter weight.
LOCKE
LOCKE DEPARTMENT
GENERAL ELECTRIC COMPANY
BALTIMORE, MARYLAND

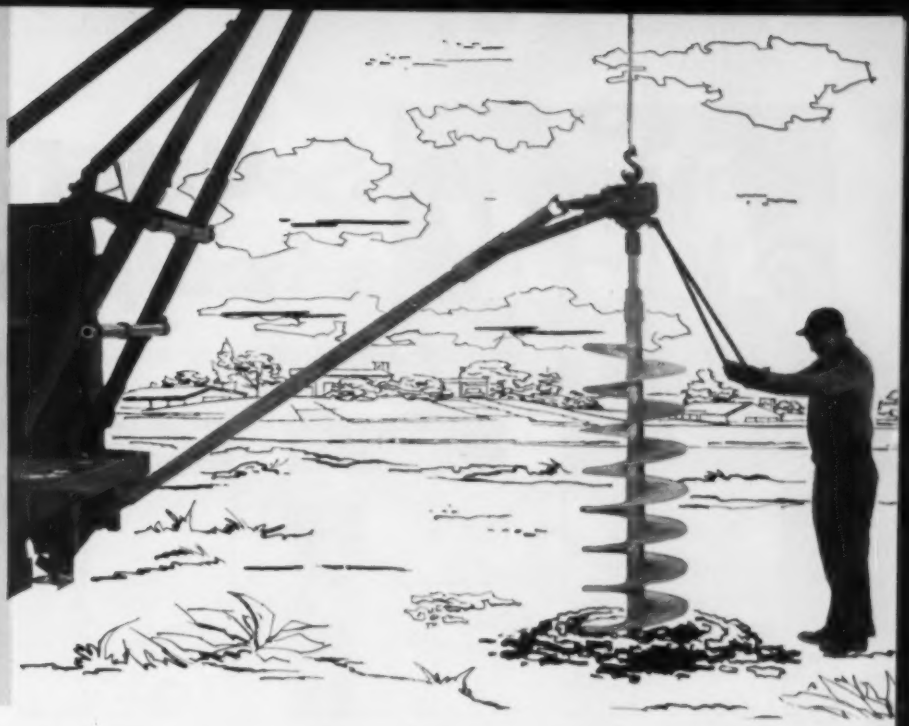
Line construction bodies for light to heavy-duty. Crew compartments optional. Efficient tool compartments and drawers.

Bodies for truck driven air compressors. Designed to accommodate hose reels, tapping machines, jack hammers, etc.

Service bodies for chassis up to 1½ ton. Lengths, 75", 84", 90" and 102".

Tree trimmer body accommodates 7-man crew. Aerial and winch equipment optional. Side rack hinges for easy unloading of brush.

Gas Service body with forward-mounted air compressor, independently engine driven.



Model 4401-M Holan Portable Earth Borer takes the drudgery out of digging. Ratchet overload clutch eliminates changing shear pins. High angle torque arm permits boring in hilly ground.

# MECHANIZED "MOLE" WITH A NEW TWIST

Hydraulic derricks designed for front or rear mounting. Capacities to 12,000 lbs.

Ladders to 40' with all phases completely hydraulic. Pump actuated by P.T.O. or separate engine drive with electric starter.

Hydraulic jacks, controlled from rear of truck. Rigid mounted or patented Holan self-stowing types.



Portable mechanical and hydraulic earth borers with optional rotation.

Wide variety of pole and reel trailers. Standard and special. Many optional features.



Hydraulic towers with rotary, stationary, or transverse platforms. Exclusive box-girder telescoping mast.

*Your* hole boring problems challenged Holan engineers to fashion a truly efficient portable digger . . . one that would obsolete earlier models. Instead of modifying existing equipment, they started with a blank sheet and *engineered* from the ground up! The few mechanical details shown here hint at the many benefits you will gain from a HOLAN borer . . . benefits in cost, service, safety, durability, performance . . . *and* crew morale!

**WRITE FOR DETAILS.**

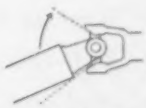
Request 4401-M Folder.

Torque arm drive shaft is 2" square tubular steel telescoping into 3½" round tube . . . extremely rigid and lightweight.

Specially designed pinion and ring gear housing is rugged impact-resistant malleable iron.

Heavy-duty Holan auger with shallow-pitch steel flighting welded to seamless steel shaft. Hardened edge beading optional.

Engine wise or counter-engine rotation available for corresponding drives.



Extra steep angle universal joints provide wide range in rolling terrain.

Shaft Bearings and oil seals are highest quality to reduce frequency of service repairs.

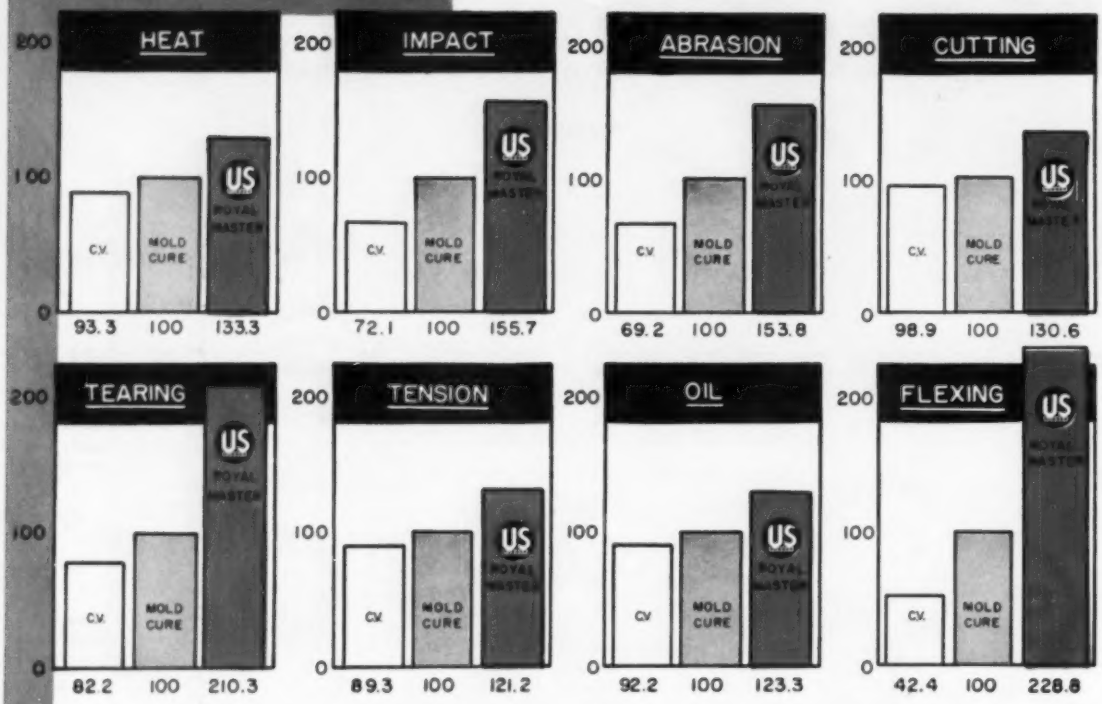
Self-centering type cutting head with balanced thrust reduces wear. Specially hardened replaceable points and pilot bit.

"You"-tility Engineered by J. H. HOLAN CORPORATION

4100 WEST 150 ST. • CLEVELAND 11, OHIO

THE NAME THAT MEANS WORK SIMPLIFICATION

# New U.S. ROYAL outperforms,




**Comparative performance of portable cords related to major life factors.**

Graphs illustrate the outstanding superiority of new U. S. Royal Master Cord—over the average of molded cords and the average of short-lived continuous vulcanized cords of other makes—on every major life factor. (Average of other molded cords is rated at 100%.)

US RUBBER

**UNITED STATES**

**ELECTRICAL WIRE AND CABLE DEPARTMENT**

# MASTER portable cord *outlasts all others!*

**Comparative tests show U. S. Royal Master gives $1.88 in value for every $1.00 spent — almost *twice* the service value of the average of other molded cords!**

LOOK FOR THE NAME — U. S. ROYAL MASTER

Two years ago, "U. S." engineers began a *complete reexamination* of portable cord construction, service life, and the causes of cord failure.

Over 10,000 tests were made. More than a thousand cords of all leading makes, including our own famous U. S. Royal Cord, were analyzed, tested, and compared.

Every life factor was considered and carefully evaluated, alone and in its relation to overall cord performance and service life.

Backed by 64 years of experience in the manufacture of electrical wire and cable, U. S. Rubber engineers then translated their findings into an entirely new portable cord, designed to surpass any other previously made.

Extensive tests, both in the laboratory and in outside plant installations have proved this new portable cord startlingly superior in every respect!

**New U. S. Royal Master is unquestionably the finest cord you can buy!**

From every standpoint, as the charts at left illustrate, new U. S. Royal Master is a finer, more durable cord—actually gives 88% longer life than the average of competitive molded cords—far longer than *any* other cord—surpassing even a hypothetical cord incorporating the best features of all those tested!

Far greater value, too! In spite of almost doubled service life, this great new cord is in the same price category as other molded cords—giving you $1.88 in cord value for every cord $1.00!

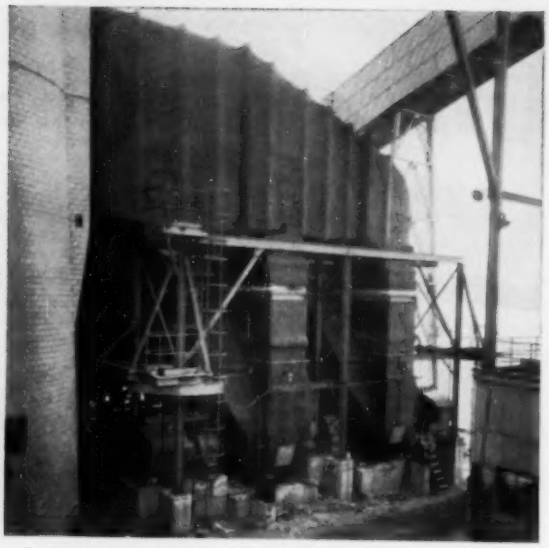
Prove to yourself the outstanding superiority of new U. S. Royal Master Portable Cord—in both service life *and* economy! Write address below for FREE descriptive booklet illustrating the superiority of the U. S. Royal Master Cord. And get in touch with your "U. S." distributor today.

Approved by Underwriters' Laboratories, Inc.

**RUBBER COMPANY**

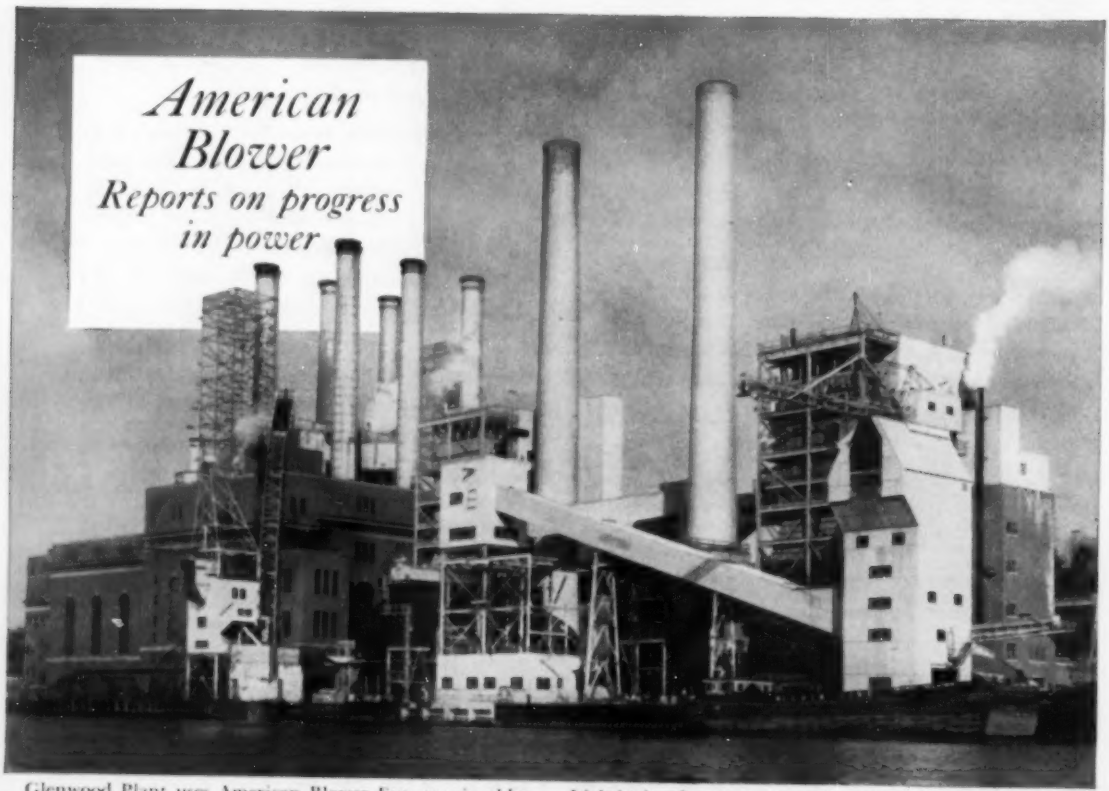
**ROCKEFELLER CENTER, NEW YORK 20, N. Y.**

1. Two new units at Long Island Lighting's Glenwood Plant add 220 Mw to plant's capacity. Note outdoor turbines (foreground) — first in northeast area of U.S.

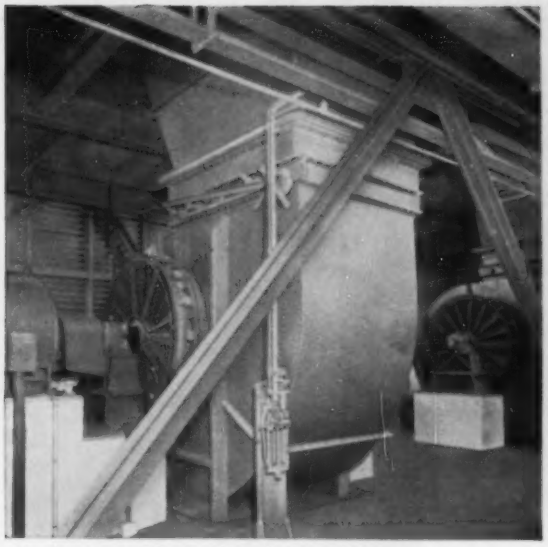


2. These two American Blower Induced Draft Fans are installed on unit #5 at Glenwood Plant. Each has capacity of 197,000 cfm @ 275°F @ 17.10 sp. @ 703 rpm.

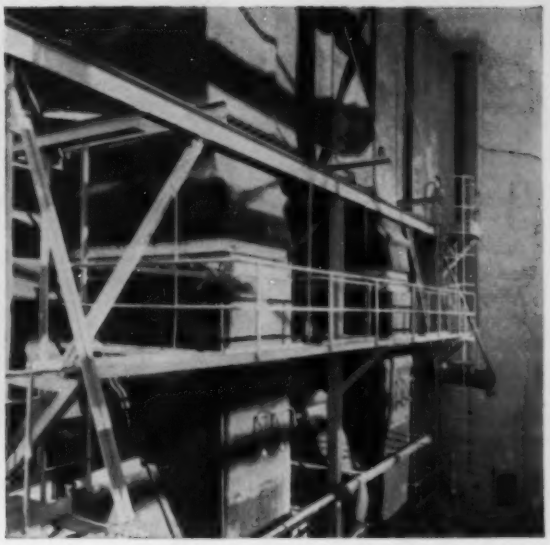
# Long Island Lighting pioneers




Glenwood Plant uses American Blower Fans on six older units and new outdoor-type units (right). Long Island Lighting's other generating plants include: Port Jefferson, Far Rockaway and Edward F. Barrett stations.



3. American Blower Forced Draft Fans on Glenwood's #4 unit are each rated @ 135,000 cfm @ 100°F @ 12.75 sp. @ 875 rpm.



4. These American Blower Induced Draft Fans are installed on Glenwood's #4 unit. Each fan is rated at 197,000 cfm @ 275°F @ 17.10 sp. @ 703 rpm.

# use of outdoor-type units in Northeast; operations reflect design progress!

**Leading power company shows *progress in power* with new outdoor construction, reheat cycle and American Blower Fans**

SINCE THE second world war, the Long Island Lighting Company has spent millions on expansion — over $150,000,000 on electrical facilities alone. Operating efficiencies have gone up.

The use of the reheat cycle and high steam pressures and temperatures have cut fuel costs. New outdoor-type generating units permitted greater flexibility and saved in construction costs. However, these new units, using American Blower Forced and Induced Draft Fans, have provided more than flexibility and savings: they are also free from objectionable noise.

When it comes to air handling equipment, leading power and industrial plants prefer American Blower equipment for its quiet, dependable operation, for indoor as well as outdoor-type installations.

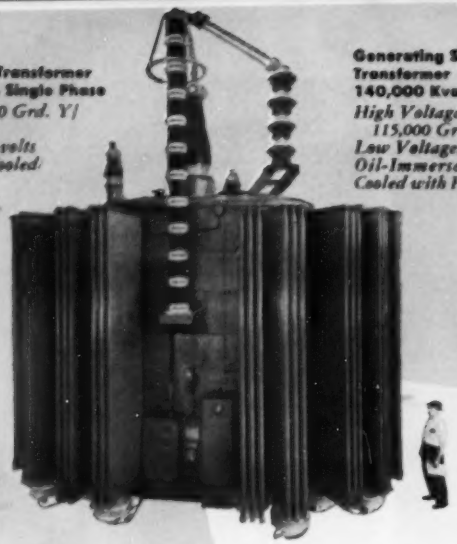
Whether *your* modernization or expansion plans call for Mechanical Draft Fans, Fly Ash Precipitators, Dust Collectors, Heavy Duty Steam Coils or Gyrol Fluid Drives for boiler feed pump and fan control — profit by discussing your needs with an experienced American Blower representative. Call your American Blower Branch Office, today, or write us direct.

**AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN**
**CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO**
Division of American Radiator & Standard Sanitary Corporation

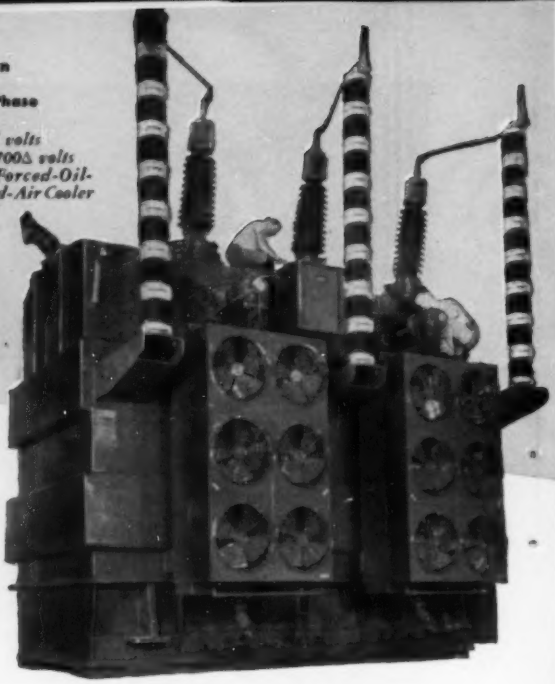
**AMERICAN BLOWER**

*Serving home and industry:* AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS

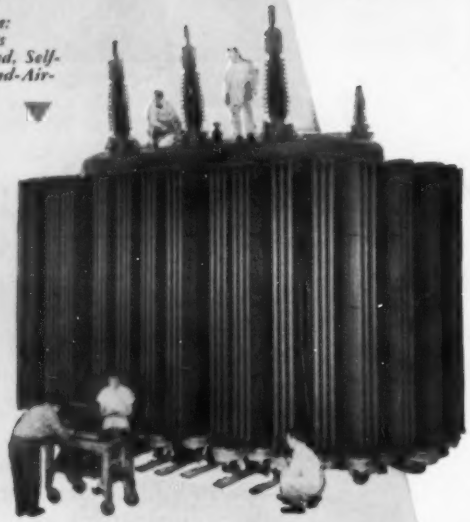
**Generating Station Transformer**
**84,000/70,000 Kva, Single Phase**
*High Voltage: 161,000 Grd. Y/ 93,000 volts*
*Low Voltage: 19,000 volts*
*Oil-Immersed, Self-Cooled/ Forced-Air-Cooled*



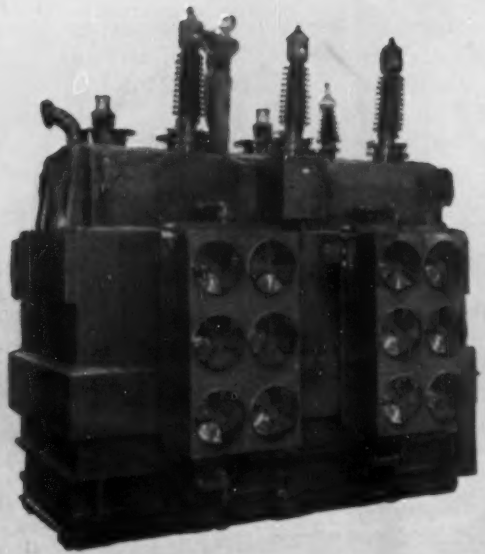
**Generating Station Transformer**
**140,000 Kva, 3 Phase**
*High Voltage: 115,000 Grd. Y volts*
*Low Voltage: 14,700Δ volts*
*Oil-Immersed, Forced-Oil-Cooled with Forced-Air Cooler*



**Generating Station Transformer**
**68,000/90,666 Kva, 3 Phase**
*High Voltage: 132,000 Grd. Y/ 76,200 volts*
*Low Voltage: 13,200Δ volts*
*Oil-Immersed, Self-Cooled/Forced-Air-Cooled*

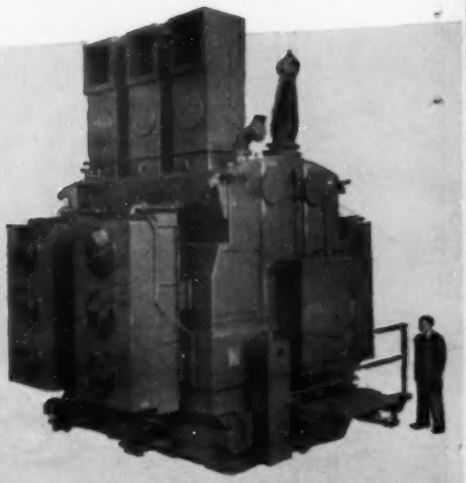


# REPRESENTATIVE Power Transformers MANUFACTURED BY PENNSYLVANIA IN 1954

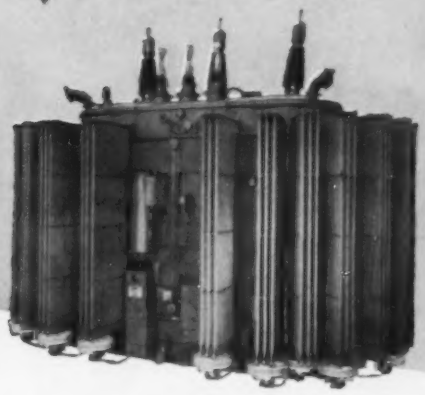


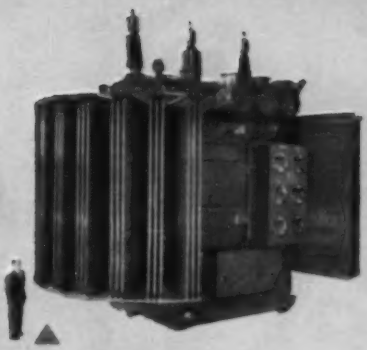
**Generating Station Transformer**
**175,000 Kva, 3 Phase**
*High Voltage: 115,500 Grd. Y volts*
*Low Voltage: 17,500Δ volts*
*Oil-Immersed, Forced-Oil-Cooled with Forced-Air Cooler*

**Generating Station Transformer**
**120,000 Kva, 3 Phase**
*High Voltage: 145,000 Grd. Y volts*
*Low Voltage: 19,800Δ volts*
*Oil-Immersed, Forced-Oil-Cooled with Forced-Air Cooler*



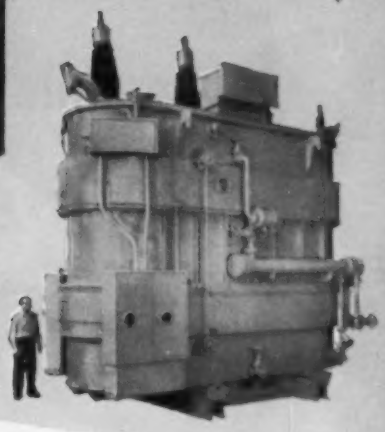
**Generating Station Transformer**
**56,000/70,000 Kva, 3 Phase**
*High Voltage: 132,000Y volts*
*Low Voltage: 15,000Δ volts*
*Oil-Immersed, Self-Cooled/Forced-Air-Cooled*





**Substation Transformer**
**45,000/60,000 Kva, 3 Phase**
*High Voltage: 125,400Δ volts*
*Low Voltage: 13,800Y volts*
*Oil-Immersed, Self-Cooled/Forced-Oil-Cooled with provision for future OA/FOA/FOA rating of 75,000 Kva*

**Generating Station Transformer**
**48,000 Kva, 3 Phase**
*High Voltage: 115,000 Grd. Y volts*
*Low Voltage: 13,200Δ volts*
*Oil-Immersed, Forced-Oil-Cooled with Forced-Water Cooler*

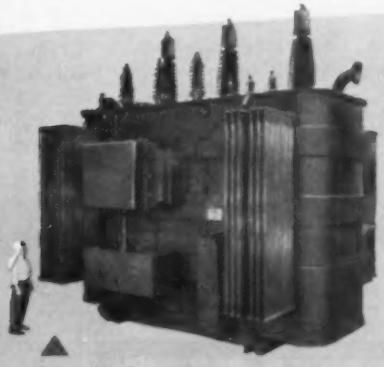


Here are some of the single phase and three phase power transformers manufactured by Pennsylvania in 1954. They are representative of the large core-form and contour-design (shell-form) transformers that are preferred by leading utilities and industrials. Some of these units are for generating station service. Others are typical power transmission transformers. Every type of cooling method is represented in these transformers. Typical accessories include load tap changing mechanisms, lightning arresters, and potential devices. In short, these transformers represent Pennsylvania's complete coverage for the large power transformer needs of this country.

Expanded plant facilities also made it possible for Pennsylvania to offer transformers in ratings up through 350,000 Kva and in voltages through 330 Kv. This includes load tap changing transformers up to 150,000 Kva.

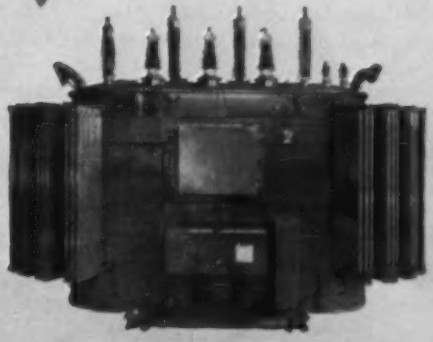
It is significant, too, that 1954 was a record-breaking production year at Pennsylvania, indicating in a concrete manner the trust placed in Pennsylvania Transformer Company, its people and its products.

**PENNSYLVANIA TRANSFORMER COMPANY . CANONSBURG, PA.**
*A McGraw Electric Company Division*



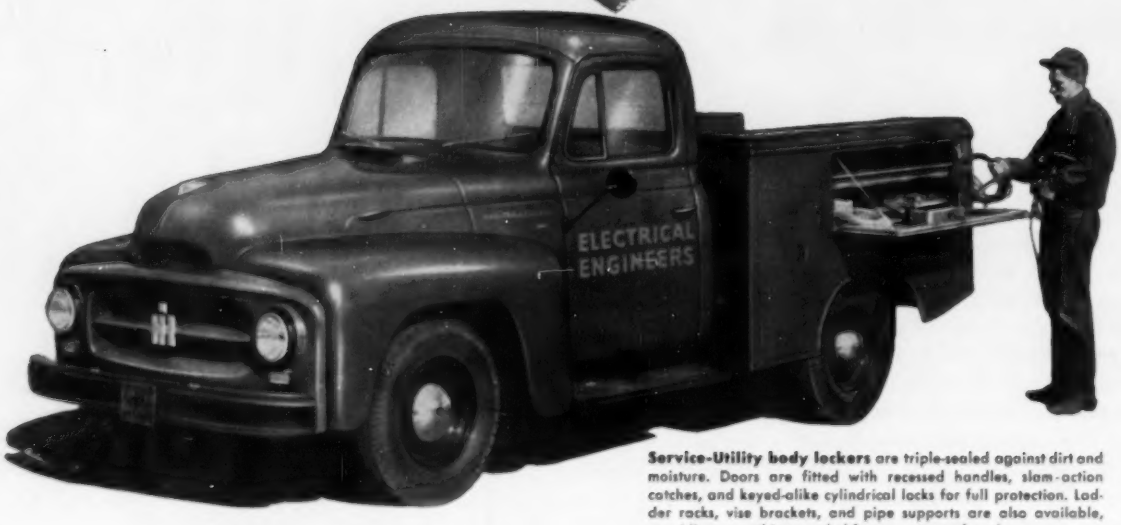
**Substation Transformer**
**15,000 Kva, 3 Phase, with load tap changing equipment**
*High Voltage: 154,000Y volts*
*Low Voltage: 69,000 Grd. Y volts with plus and minus 10% regulation in 32—5/8% steps*
*Tertiary Voltage: 12,470Δ volts*
*Special design for shipping in one-piece tank*

**Substation Transformer**
**25,000 Kva, 3 Phase, with load tap changer**
*High Voltage: 138,000Y volts*
*Low Voltage: 69,000 Grd. Y volts with plus and minus 10% regulation in 32—5/8% steps*
*Tertiary Voltage: 12,400Δ volts*
*Oil-Immersed, Self-Cooled*



**Substation Transformer**
**30,000 Kva, 3 Phase, with load tap changing equipment**
*High Voltage: 66,000Y volts, with plus and minus 5% regulation in 32—5/8% steps*
*Low Voltage: 33,000Y volts*
*Tertiary Voltage: 13,800Δ volts*
*Oil-Immersed, Forced-Oil-Cooled with Forced-Air Cooler*

# This mobile workshop cuts on-job cost!




**Service-Utility body lockers** are triple-sealed against dirt and moisture. Doors are fitted with recessed handles, slam-action catches, and keyed-alike cylindrical locks for full protection. Ladder racks, vise brackets, and pipe supports are also available, providing everything needed for every type of work.

**INTERNATIONAL Trucks,** with Service-Utility bodies, cut service call costs by bringing your workshop to the job. You make fewer trips, get more done per day.

The Service-Utility body provides all-steel lockers, with compartments of varying sizes, for orderly storage of all the tools, parts, and equipment needed to do a number of different jobs. Thus, there is no costly labor-time wasted in job-to-shop trips for needed or forgotten items.

And INTERNATIONAL Truck quality further lowers your operating costs. Famous INTERNATIONAL engines assure top performance with maximum economy. INTERNATIONAL Tough-Job engineering and all-truck design mean utmost dependability, long life, and lowest maintenance expense.

INTERNATIONAL Trucks with Service-Utility bodies are available in 9 models, with 77-in. body lengths for 115-in. wheelbases, 84-in. lengths for 122-in. wheelbases, 89-in. lengths for 127-in. wheelbases and 96-in. lengths for 134-in. wheelbases. GVW ratings, 4,200 to 8,600 lbs.

Ask your INTERNATIONAL Dealer or Branch for complete details on these time-saving, money-saving workshop trucks. Time payments arranged.

**INTERNATIONAL HARVESTER COMPANY • CHICAGO**

International Harvester Builds **McCORMICK®** Farm Equipment and **FARMALL®** Tractors...Motor Trucks...Industrial Power...Refrigerators and Freezers

***See the season's new TV hit, "The Halls of Ivy," with Ronald Colman and Benita Hume, CBS-TV, Tuesdays, 8:30 p.m. EST***

**INTERNATIONAL® TRUCKS**

*"Standard of the Highway"*

# Right off your Square D Distributor's shelf!

## New QMB Saflex Distribution Panelboard

**Exactly the Power Panelboard you want**—when you want it. Your Square D Distributor stocks boxes, interiors and plug-in units which can be quickly assembled to meet virtually any specifications. Above, interior ready for easy mounting in box.

**Plug-In Units** are installed easily on tubular bus bars. The solid neutral can be changed in minutes. Here is flexibility that reduces "down time" and saves money.

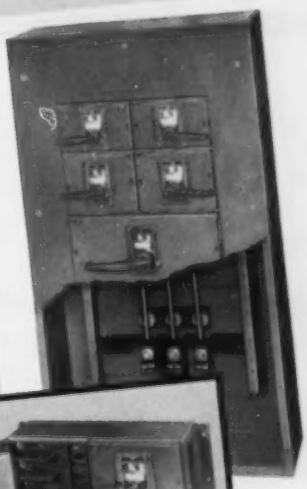
**Three Simple Assembly Steps** Fronts, with adjustable trim clamps, are available with or without doors.

## With ALL these Quality Features

**INTERIORS** are flexible and adaptable to almost any service and voltage. Plug-in units and solid neutral can be changed simply and quickly.

**BOXES** provide generous wiring space.
**FRONTS** furnished with or without doors have adjustable trim clamps.

**UNITS** have quick-make, quick-break switch mechanism, visible blades and are horsepower rated. 30, 60, 100 and 200 ampere units are plug-in, while 400 and 600 ampere units are bolted to the bus.



*•Underwriters' Approved for Service Entrance*

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY

# 4 OPERATION-PROVED OF *Super*

**1** Save on Plant Costs. A steam turbine generator unit with supercharged cooling produces significant savings both in area of plant and in foundation design. For example, in total plant space a 150-mw unit will require 20 feet less because rotor-removal distance is shorter than that of conventionally cooled units. In foundation length at least 10 feet can be saved, and foundation loading is reduced because stator weight is only a fraction of that for conventional cooling. The corresponding reduction in crane span and lifting capacity affords further savings.

**2** Save Switchgear Costs. Savings are possible because of higher reactances and consequently lower fault currents. The 2-pole fully supercharged machine has reactances almost identical to those of a large 4-pole generator.

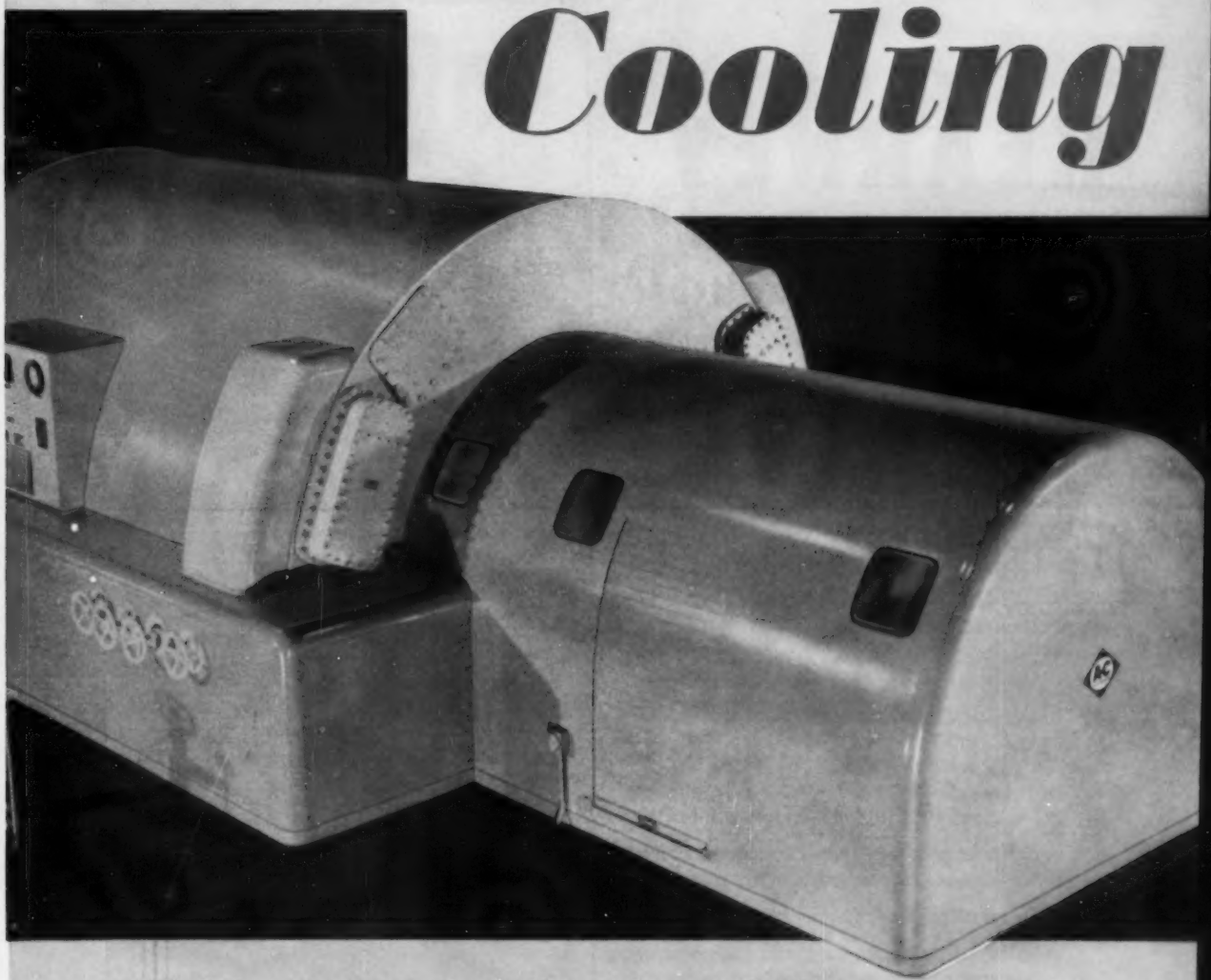
**3** Reduce Conductor Expansion . . . because the axial length of the generator is much less than that of a conventionally cooled machine. In addition, the average and differential temperatures are lower.

**4** Simplified Installation and Inspection. Light weight and compact design facilitate handling, reduce bearing and seal size. Oil and gas requirements are minimized.

**For units of present-day capacities,** like the steam turbine generator unit shown above, supercharged cooling has proved a means for providing important economies. In addition, operation of these units since 1951 shows that

**ALLIS-**

# ADVANTAGES *charged Cooling*



this Allis-Chalmers pioneered development lifts the lid off future increases to higher capacities.

Supercharged cooling by Allis-Chalmers combines conductor-cooling with high velocity scrubbing action of gas over ample exposed area.

Developments like this prove you can count on Allis-Chalmers for pace-setting engineering leadership. It will pay to consult the A-C office nearest you when planning begins. Or write Allis-Chalmers, Milwaukee 1, Wis., for more information.

**CHALMERS** A-C ALLIS-CHALMERS

A-4479

# DEPENDABLE...

***despite weather or structural warpage!***

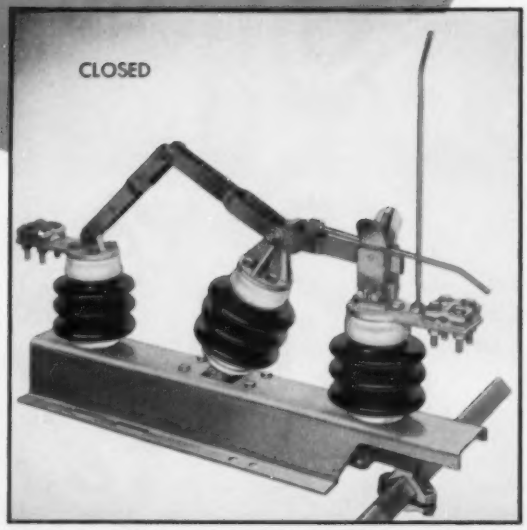
# KEARNEY

## Tilting Insulator Group-Operated Switches

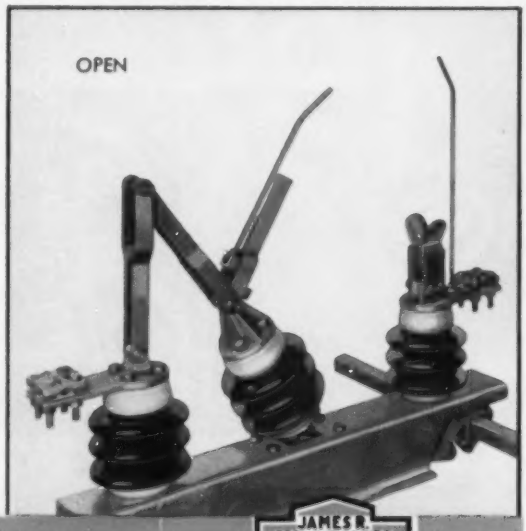
Here's a truly trouble-free disconnect! Even under extreme icing conditions, the "pry-out" blade breaks free easily. The high leverage of the Kearney "toggle" linkage lifts it from the jaws smoothly and easily . . . closes it without slam or damage to the insulators.

And it will work perfectly even if the switch poles are out of alignment. The interphase shaft clamp is designed to compensate for structural warpage. For easy installation, the interphase shaft can be lifted into the clamps after the switch is in position.

- *Oilite bearings support the tilting insulator*
- *Extra long jaws . . . blade travel adjustment need not be critical*
- *Silver-plated blade-to-jaw contacts*
- *Sturdy, deep-drawn base with wide bearing flange to prevent cutting into crossarms*




*TYPE KT-3 Ratings 400 - 600 AMP. 7.5 to 34.5 KV.*




275

*For Better Construction . . . Safer Maintenance*

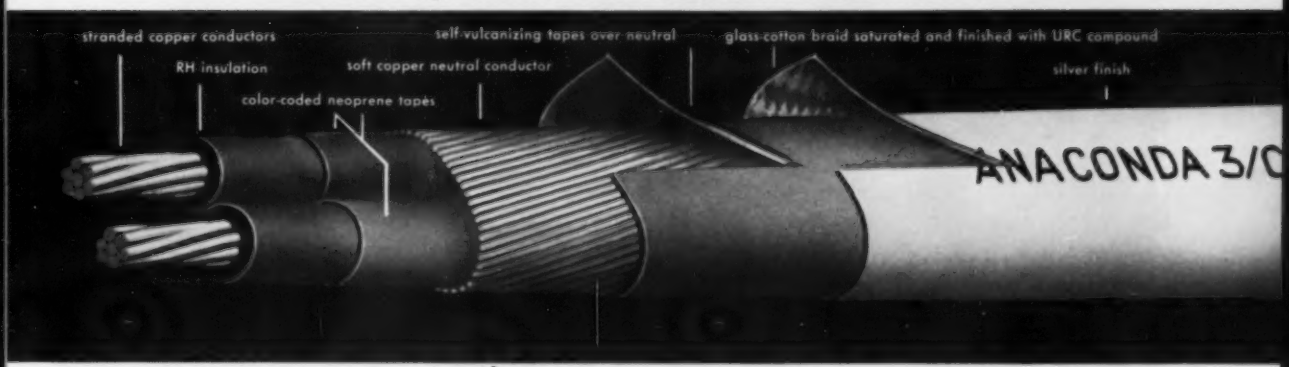
*Specify* **KEARNEY** *The Mark of Quality* **PRODUCTS**

JAMES R. KEARNEY CORPORATION • 4226-42 CLAYTON AVENUE, ST. LOUIS 10, MISSOURI • Canadian Plant GUELPH, ONTARIO

ANACONDA ANNOUNCES—NEW

# SILVALINE 100-AMP service entrance cable

**The *only* SE cable with URC† saturant and finish**




**Here's a new Underwriters Type SE service entrance cable that complies with NAHB Voluntary Adequate Wiring Code... and will help you boost kwhr sales.**

The new Voluntary Adequate Wiring Code of the National Association of Home Builders calls for 100-amp service into the home.

Adequate capacity in service entrance for homes insures your future sales of electrical energy—because it removes the *initial* bottleneck to the sale of high-current appliances.

And now, Anaconda introduces the new Silvaline* 100-AMP (actually 115-amps) TYPE SE cable. Made with #2 AWG copper—and Type RH insulation.

*Here are other advantages:*

**Uninterrupted Service.** *Silvaline is the only service entrance cable with URC† saturant and finish* ... will not festoon or deteriorate. URC weather-proof protection will stay put—assures long life operation and eliminates trouble calls.

**Eliminates Complaints:** Silver finish on Silvaline takes any type or color of house paint... won't bleed through. Will not flake or peel. No complaints from homeowners when Silvaline is used.

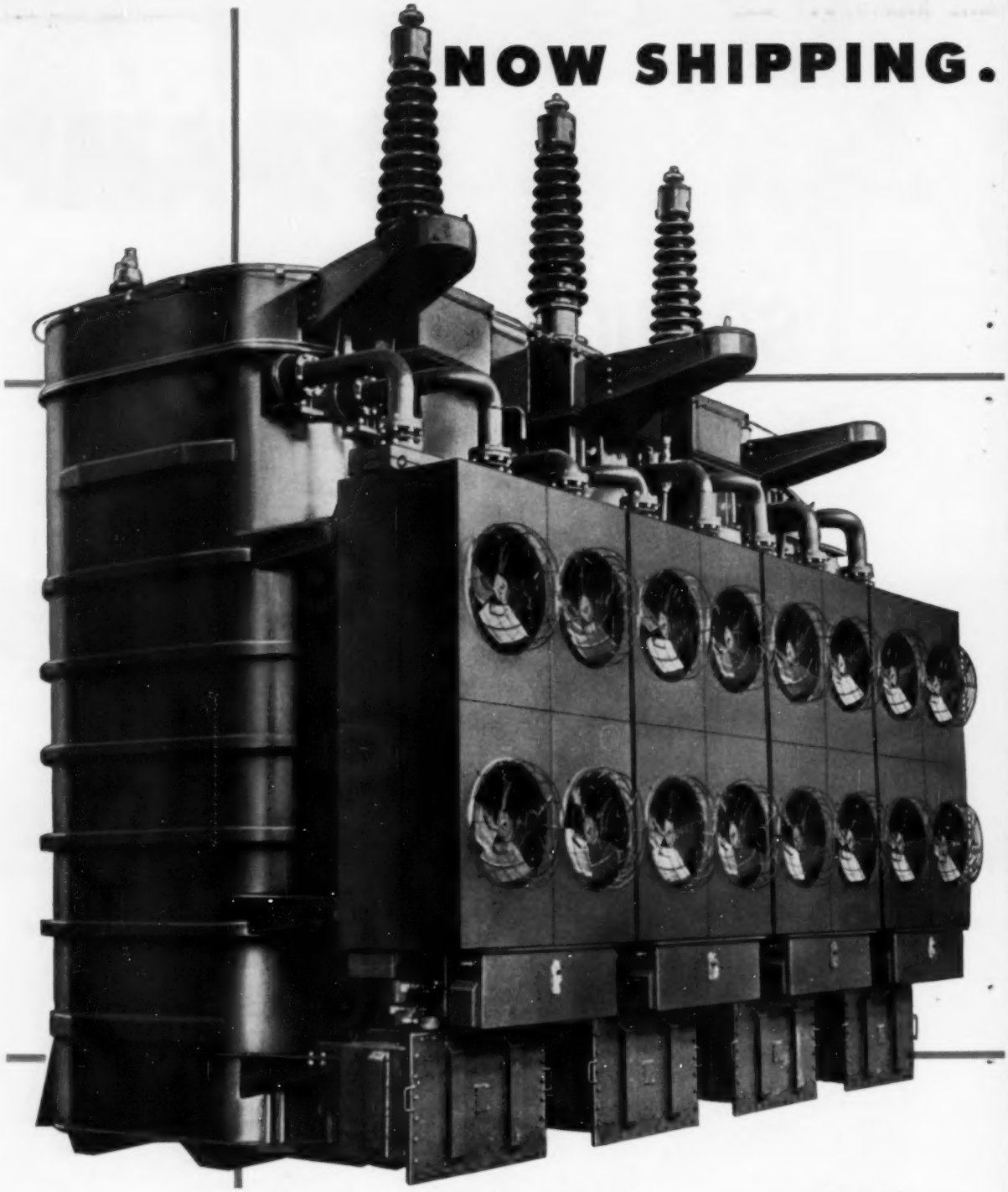
Silvaline 100-AMP cable is now available. For more information, contact your local Anaconda representative or write: Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

*Reg. U.S. Pat. Off. †Utilities Research Commission

SILVALINE *service entrance cable*

ANACONDA®

# NOW SHIPPING.



**MOLONEY ELEC**

*Power Transformers • Distribution Transformers • Step Voltage*
*Load Center Transformers • Unit Substations • Network Transformers*

**SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES**

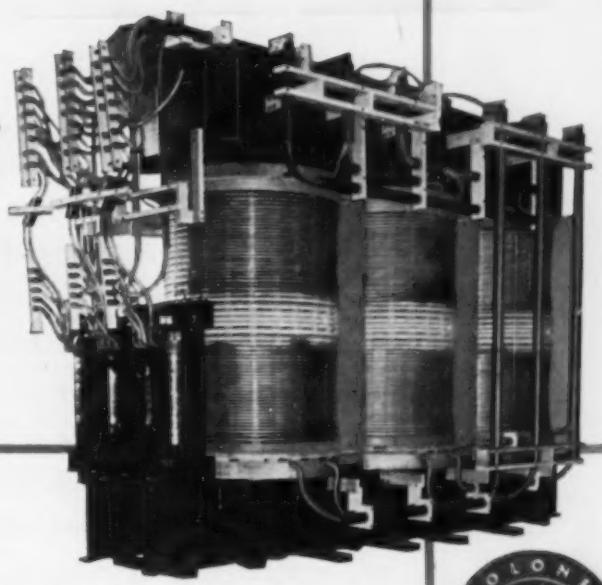
# •• HIGH KVA TRANSFORMERS FROM

# THE NEW MOLONEY ELECTRIC POWER BAY

**This 125,000 Kva, three-phase, Power Transformer recently shipped to Union Electric Co. of St. Louis for installation at their Cahokia Generating Plant.**

Load Tap Changing Transformer rated 125,000 Kva, three-phase, with a high voltage of 138,000 volts grounded wye and a low voltage of 13,800 volts delta with load tap changing equipment providing plus or minus 10% voltage regulation in 32 equal steps of ⅝%. Four Unit Coolers each with separate oil pumps provide ample heat transfer for this oil-immersed forced-oil cooled transformer with forced-air-coolers (Class FOA Cooling System). This unit will be installed with 115 Kv self supporting lightning arresters.

This transformer will serve as a tie between a 13.8 Kv generating bus and a 138 Kv transmission line and is equipped with two independent delta connected low voltage windings each rated 62,500 Kva and each brought out through the tank cover separately. The switching reactor is mounted on the side of the core-and-coil with the load tap changing switch mechanism leads directly above. Both the Load Transfer Switch and the Tap Selector Switch are located in oil-tight compartments, each separate from the other and both separate from the main core-and-coil.



MEBB-6

## TRIC COMPANY

*Regulators • Regulating Transformers • Load Tap Changing Transformers*
*Constant Current Transformers • Capacitors • Transformers For Electronics*

AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

# kerite acknowledges

with thanks the good wishes received during
the celebration of our 100th anniversary.
We have been privileged to form many
lasting associations over the past century
and hope to merit their continuance.

Now, on the threshhold of a second century,
we pledge a continuance of the same vigorous pioneering spirit
that produced Kerite insulation and the many
original developments which have protected its integrity
and extended its application.

**KERITE CABLE**

THE KERITE COMPANY—30 Church St., New York 7, N. Y.
Offices also at 122 S. Michigan Ave., Chicago; 582 Market St., San Francisco;
3901 San Fernando Rd., Glendale 4, Calif.; 31 St. James Ave., Boston

# You WERE Right, Mr Moses

"There is, of course, a way of having the state control the entire power situation and that is to issue state bonds to develop power, condemn private interests, carry the power into the street lamps and into the homes and turn over its operation to an immense new body of government employees with all of the incompetence, patronage, and waste that go with such an operation. It can be done if the taxpayers are ready to pay the bill."

The above quotation is from the opening campaign speech of Robert Moses in his unsuccessful race for governor of New York in 1934. This excerpt has particular significance today because this same Robert Moses is now chairman of the Power Authority of the State of New York and charged with the responsibility of foisting upon his state and nation the very situation he decried while running for high office.

Mr Moses has already issued state-backed bonds to develop a considerable block of power from the St. Lawrence project. He is gradually gathering together a "new body of government employees . . ." to administer and operate that project. He may even succeed in preventing some of the "incompetence, patronage, and waste" that he warned of in 1934.

Now comes Mr Moses with a characteristically vigorous statement that he is ready and eager to develop a vast new block of power at Niagara Falls under the auspices of the State (EW, Jan. 10, p 53).

The state plan although identical in design is in direct conflict with the one put forward by the five leading electric companies in the state. The five-company plan offers to develop additional power at Niagara free of the stifling government bureaucracy which worried Mr Moses so much a score of years ago. For nearly five years these companies have stood ready with a firm and positive program for developing the available power at the Falls. What's more, they would pay taxes on their operations though the Moses' program for state development would not.

Much of his recent statement consists of the argument that free enterprise development of Niagara power would be less effective than state development in preserving the natural beauty of the areas surrounding the Falls.

In 1952 as chairman of the State Council of Parks, and presumably responsible for preserving the natural beauty of the area, Mr Moses took a different view. In a pamphlet issued over his name by the Niagara Frontier State Park Commission, it was stated: "The Niagara Frontier Park Commission takes no stand favoring one or another of these bills. However the work is done, its program can go forward if a share of the profit from power development is allocated to the . . . commission." The bills referred to were the three then pending before Congress for additional power development at Niagara. One would have provided for private enterprise development, a second for state development, and a third for federal development.

In his recent statement Mr Moses did not call up the chief argument which his patron, former Gov Thomas E. Dewey, had used in boosting state development. This argument was that the state could produce the power cheaper as it would not be required to pay federal taxes on its operations.

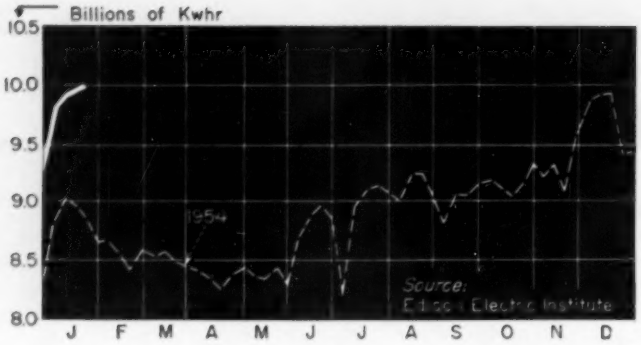
The five companies which seek to develop the power have correctly pointed out that this escape from federal taxes would merely mean that taxpayers throughout the nation would have to make up the loss. Federal taxes must be paid.

Yes, Mr Moses, you are probably right when you say that your Power Authority of the State of New York would be able to carry out the Ningara power development.

As you said with reference to St. Lawrence development, "It can be done if the taxpayers are ready to pay the bill."

# THE ELECTRICAL WEEK






**Week Ended Jan. 29**

**10,003,000,000**

**Up 13%**

Per Cent Change From Previous Year

| | Total US | New Eng. | Mid. Atlan. | Cent. Ind. | West Cent. | South-east | South Cent. | Rocky Mount. | Pacific NW | Pacific SW |
|---|---|---|---|---|---|---|---|---|---|---|
| Jan. 29 | +13.0 | +5.1 | +5.8 | +12.5 | +5.2 | +28.6 | +7.2 | +9.3 | +5.3 | +9.1 |
| Jan. 22 | +11.2 | +3.9 | +4.6 | +9.4 | +3.0 | +25.5 | +8.5 | +7.3 | +5.0 | +10.0 |
| Jan. 15 | +10.1 | +2.9 | +3.1 | +8.0 | +2.5 | +22.2 | +8.5 | +7.8 | +11.9 | +7.9 |

Seasonally Adjusted Index 182.4 Week Ago 181.1 Year Ago 161.3

**The Issue's News Highlights . . .** Electrical equipment manufacturers tell House committee that lower tariffs on imports of foreign electrical goods will weaken domestic industry and jeopardize U. S. security . . . AEC Commissioner Murray reversed himself when he called for end of Dixon-Yates contract at Joint Committee session . . . AEC reveals details on its plan for further implementation of atomic law . . . AIEE Winter General Meeting hears talks by President Monteith and Brig Gen Sarnoff.

**Climaxing fastest rate of growth** in its 75-year history, electric industry for week ending Jan. 29 hit new all-time peak by producing over 10 billion kwhr. Output has doubled since week ended Sept. 13, 1947, when 5 billion kwhr was produced.

**New York State Power Authority** awards contract to General Electric for 16 generators for U. S. half of Barnhart Island Powerhouse on St. Lawrence Power Project. There were seven bidders of which three were foreign. GE was only bidder on all 16 generators with quotation of $13,210,721. Brown Boveri & Co of Switzerland was only competitor in price, submitting bid on four generators.

**Much of today's electric power service** is being sold at too low a price, says A. W. Howard, president, Canadian Electrical Association, and general manager, Calgary Power. Service is under-priced when related to its true value to the customer, he adds. Economic changes in recent years, he continues, call for reappraisal of whole basis of electric power rates.

**Duquesne Light** has selected the proposal of Burns & Roe, Inc, as most favorable of five for installation of conventional steam plant equipment at the Shippingport nuclear power station. Associated with Burns & Roe will be J. Rich Steers, Inc., and Hatzel & Buehler, Inc., all three firms from New York.

**Sears-Roebuck** is reported encountering difficulties in marketing its high-speed, 8,600-watt electric clothes dryer. Inadequate wiring is proving major obstacle, and utilities don't welcome the load. Whirlpool, maker of unit under the Sears Kenmore label, is watching developments before producing its own high-speed model.

**Oregon House** has approved memorials to Congress which: Ask for funds for Green Peter and Cougar Dams in which local groups would supply funds for power installations; call on Congress to either declare its intent to build John Day with federal funds or allow local agencies to proceed.

## NEWS OF THE INDUSTRY BRIEFLY TOLD

**Dixon-Yates** . . . President Eisenhower will not back down on the Dixon-Yates contract. At his press conference last week he said he would not order contract cancelled and noted that vote in favor of cancellation by Joint Atomic Energy Committee was strictly along party lines . . . Further support came from Harold Quinton, president of EEI who telegraphed Edgar H. Dixon, president of Middle South Utilities, stating that "investor-owned Electric Power Industries wholeheartedly support basic philosophy of government in calling on private enterprise to perform those jobs it is willing and able to do . . . You and Yates (Eugene Yates, chairman, Southern Co) and electric utility organizations you represent are doing splendid service in public interest in standing firm on Mississippi Valley Generating contract."

**Iowa legislature** considers bill to substitute a utilities commission for present State Commerce Commission. New agency would regulate rates and financing and have jurisdiction over rural electric co-ops, municipalities, and private companies . . . Texas legislature receives bill to establish a public utilities commission to regulate electric, gas, and telephone utilities in Texas.

**John L. Lewis,** chief of UMW, accuses TVA of buying low-cost coal to improve its competitive position with private utilities. He tells Labor Department hearing that TVA has used its vast influence of heavy purchasing to beat down small coal producers to "starvation wages" . . . Colorado Ute Electric Association, a co-op group, will build 25,300-kw steam generating plant to be operated by Western Colorado Power Co.

**Atomic Power Development Associates** will set up and test parts for an atomic-fueled electric power plant in a laboratory to be established at Detroit Edison's Delray generating plant. Group has scheduled $3.8 million for research in 1955.

**South Carolina E&G** will offer 210,053 common shares on a 1-for-15 basis, with additional subscription privileges and provision for holders of less than 15 shares. Company will pay April 1 a quarterly common stock dividend of 22½¢ a share as compared with 20¢ a share previously.

**NARUC** has switched the site of its convention this year from originally scheduled San Francisco to Asheville, N. C. San Francisco was unable to provide the hotel space. Convention date is Oct. 24-27.

## ABOUT PEOPLE IN THE INDUSTRY

**Morris D. Hooven,** electrical engineer in electric engineering department, Public Service E&G, is the nominee for president of AIEE to succeed A. C. Monteith, Westinghouse vice president. Hooven is one of AIEE's most active members, having served for four years as director and two as vice president. He is member of IRE, ASME, ASEE, NSPE. Hooven joined Public Service in 1922, two years after receiving his BS degree magna cum laude from Bucknell University. (Also see p59 for AIEE news.)

**Responding to Sen Langer's** charges that private industry is seeking monopoly of hydro resources in Pacific Northwest, Paul B. McKee, president, Pacific P&L, says "It is the investor-owned electric companies that have been fighting for their lives for past 20 years. If they hadn't had popular support in this fight, there would be a federal power monopoly ruling Pacific Northwest today. As it is, government owns and controls 60% of region's power resources, and any talk of 'private monopoly' is sheer nonsense."

**More News About People page 142**

# Equipment Makers See Danger in Lower Tariffs

Increased imports of foreign electrical equipment due to inadequate tariff protection will weaken domestic industry and jeopardize United States' security, according to industry leaders.

Chairman Philip D. Reed of General Electric Co, and President Gwilym A. Price of Westinghouse, testified to this effect before the House Ways and Means Committee in hearings on the extension of the Trade Agreements Act.

Reed noted that federal government purchases of foreign electrical equipment in 1952 totaled $2,650,000. In 1953 the figure had increased 483% to $15.4 million. While the figures are small in the total import-export picture, "the strategic equipment called for is critical to national security," he said.

While 26.5% of the government awards in 1952 where foreign competition was involved went to foreign producers, Reed continued, the proportion jumped to a total of 53.8% in 1953.

"It will be abundantly evident that inroads of this magnitude on the purchases of the largest customer we have are potentially disastrous to the industry."

## National Defense Needs Cited

Reed contended that electrical equipment and procurement from domestic suppliers "is essential to national defense."

Preparedness demands that as to essential defense items there be on hand or readily available an adequate supply of the best equipment of proven reliability, with adequate repair and replacement facilities."

As long as it continues to rely on foreign producers for power products for strategic installations, the government procurement program falls short in every one of these particulars, Reed said.

Regarding foreign suppliers, Reed made these points:

- There is no assurance that generators now on order, and which require years to build, will be completed and ready on time.
- As to proven reliability, foreign manufacturers "have not had remotely comparable experience with that of American concerns in producing large equipment."
- Foreign suppliers have no facilities in this country suitable for repair or rebuilding of any damaged major equipment.
- U. S. government can not impose safeguards on either facilities or personnel producing equipment ordered from abroad.

## Wage Differential Is Factor

Price also brought up the security angle by questioning the "propriety of allowing citizens of other countries to install equipment in projects of great defense priority where extraordinary security precautions prevail." This has happened and is still happening, he said. He urged that "no imports of power equipment should be permitted for use in critical installations."

The Westinghouse president warned against further cuts in electrical equipment tariffs when present rates "are completely inadequate" to protect the employees of the American electrical manufacturing industry against low wage foreign competition. Noting that foreign manufacturers pay their employees only one-tenth to one-third of the American wage rate, Price said foreign producers of heavy electrical equipment "can undersell us in this country by up to 30%, even after paying shipping costs and duties."

In past three years, Price pointed out, government agencies had awarded foreign bidders contracts for heavy power equipment valued at about $24 million. Under the recent easing of the Buy American Act, it could be assumed that such orders would increase in 1955.

"These purchases of foreign power equipment by government agencies can not all be justified even from the economic point of view," said Price. In many cases, he added, the government lost more in tax income by not buying from domestic suppliers than

(*Continued on page* 147)

***PHILIP D. REED:***

***"Specifically, it is our contention that the governmental procurement program with respect to power producing and related equipment has not been soundly considered from the standpoint of the impact of purchases from abroad on our national security . . ."***

***GWILYM A. PRICE:***

***"Tariff rates on imports of products that we also manufacture competitively in this country should be set at a level that approximately equalizes the difference between wages paid by our industries and those paid by competing foreign industries."***

# Dixon-Yates Pact End Asked

## AEC Commissioner Murray joins Democratic majority on Joint Committee in calling for revoking of controversial contract

Atomic Energy Commissioner Thomas E. Murray reversed himself last week and called for cancellation of the Dixon-Yates contract. The only Truman holdover on AEC had signed the contract last fall.

Murray's action came shortly after Democratic members, now a majority, on the Joint Committee on Atomic Energy ordered AEC to cancel the contract and rescinded the waiver of approval voted earlier by committee when under Republican control.

**Explains Position . . .** Murray told the Joint Committee he felt the contract should be cancelled in order to clear the air of a subject which has taken much of the commission's time in the last year. He explained that he had, paradoxically, signed the contract last fall for the same reason.

Testifying before the committee the next day, AEC Chairman Lewis Strauss denied Dixon-Yates dispute interfered with atomic weapons output.

Sen Albert Gore (D-Tenn.), vigorous pro-Tennessee Valley Authority, anti-Dixon-Yates member of the Joint Committee, telegraphed AEC Chairman Lewis Strauss the recommendation that a new formal vote be taken on the contract by AEC. It would now be difficult to foresee the outcome of any new vote in view of the widening rift between Strauss and Murray, the continued neutrality of the only other commissioner, Dr Willard F. Libby, and the loss to the commission of Joseph Campbell, a Republican who voted for the contract and who is now awaiting Senate confirmation of his appointment as Controller General.

**Rayburn Appeals to Utilities . . .** Shortly before Murray made his statement to the Joint Committee, Rep Sam Rayburn (D-Tex.) called on the private utilities making up the Dixon-Yates group to withdraw from the entire contract for the good of the utility industry.

But Edgar H. Dixon, president of Middle South Utilities, told a reporter "we couldn't get out of the contract if we wanted to, and we don't want to." He also expressed surprise at Murray's reversal in his position.

The Joint Committee's action in ordering AEC to cancel the contract and recision of the waiver of approval may not kill the power contract, but it throws a legal cloud over the agreement which may take court action.

**SEC Asks Advice . . .** Securities and Exchange Commission almost immediately took notice of the resolution, asking legal advice from all parties as to its effect on the new Dixon-Yates firm's application for approval of its financing plans. SEC wants their opinions of whether the action should be considered as having a bearing on the company's application to issue 55,000 shares of common stock to the parent Dixon-Yates firms.

Neither side knows what the legal status of the withdrawal of committee approval will be.

Rep Chet Holifield (D-Calif.) said he was withholding his original resolution calling on Congress to kill the contract for the time being because he is satisfied with the adoption of Gore's resolution.

Another Dixon-Yates development: Chairman Carl Hayden (D-Ariz.) of the Senate Appropriations Committee made plans to reorganize his committee to make room for a subcommittee on public works similar to one recently created in the House Appropriations Committee. Reorganization of the House group was aimed partly at stopping funds for a TVA transmission line to connect with the Dixon-Yates' firm's line in the middle of the Mississippi River. The reshuffle gave rise to a legislative problem concerning the Senate group's ability to consider omnibus House appropriations bills without matching committee machinery.

# New 75-Mw Unit at Deepwater Station

The control board details of Atlantic City Electric Co's newest and largest unit are explained by D. R. Ranno, superintendent at Deepwater, (second from left) to W. E. Caven, vice president-chief engineer, (far left); A. M. Newman, vice president-production; and B. L. England, president, at recent dedication of unit at Deepwater Station near Salem, N. J.

The new unit, built at a cost of more than $13 million, is rated at 75 Mw with steam conditions of 1,000F and 1,450 psig. Boiler produces 560,000 lb of steam per hr. Net heat rate of new unit is 9,680 Btu per kwhr.

# Workability of Atomic Law . . .

## . . . discussed at Joint Committee hearings. AEC gives details on its plan for renting fuels and granting licenses

First details of the Atomic Energy Commission's new plan for "renting" atomic fuels and licensing nuclear power plants and other facilities were laid before Congress last week, even as work went on at the commission to complete the program.

**Commissioners' Report . . .** At hearings before Joint Committee on Atomic Energy AEC Chairman Lewis Strauss, aided by Commissioner Willard F. Libby, and General Manager K. D. Nichols, presented a progress report on what AEC has been doing to complement the new atomic law.

Strauss said the study agreement program has been revised as the first step in putting private atomic development on a competitive basis. There are now, he said, three types of agreements available to American businessmen who want to know what atomic energy holds for them: (1) access agreements, (2) study agreements, and (3) commercial agreements.

• Access agreements require personnel security clearance limited chiefly to a fast federal check of criminal and subversive files of the appropriate agencies. This is a new service, to be called "L" clearance, and is expected to require only about 21 days, compared to the six to eight weeks now needed for the FBI and CSC to run a complete "Q" clearance.

"L"-cleared personnel in the access agreement program will be supplied with information the importance of which, security-wise, AEC has downgraded to a "confidential-restricted" classification. This is the new "gray area," or "gray zone," of information, and it will include almost all classified power reactor technology and most of the classified nuclear and basic scientific data. It does not include information critical to production technology or military application.

The access agreements program is aimed at giving a prospective participant a quick glance at information available to determine whether he wants to go into the matter further.

• Study agreements will be continued as they are now. Personnel will continue to require full "Q" clearance, and they will have access to top-level AEC data, classified "secret-restricted." Chief qualification for such agreements is specific identification of contemplated studies, including plans for experimental work.

• Commercial agreements will provide access to either confidential-restricted data, or secret-restricted data, or both as required, to those actually engaged in commercial activities involving reactor technology, as opposed to those merely evaluating its prospects. The commission expects most of these to require only "L" clearance. Reports will not be circulated outside the commission.

MAJ GEN KENNETH D. NICHOLS

### *Nichols to Quit Post as Manager of AEC*

**Maj Gen Kenneth D. Nichols will resign his position as general manager of Atomic Energy Commission effective May 1. He plans to enter a private firm as consulting engineer.**

**In his letter of resignation, Nichols told AEC Chairman Lewis Strauss he wanted to go into private business for "personal reasons." He emphasized his resignation was not caused by "any conflict of any kind" on matters of policy.**

**Deputy General Manager R. W. Cook is considered a likely candidate to succeed Nichols.**

**"Gray Area" . . .** The new "gray area" is expected to contain at the outset some 16,000 classified technical reports, and more will be added. In addition, "L"-cleared personnel will be given a special edition of AEC's classified abstract of reports from which to choose those they wish to "borrow," up-to-date editions of the reactor handbook in four volumes, special editions of the AEC's quarterly classified journal, and a bibliography of the industry's most significant reports.

Joint Committee Chairman Clinton P. Anderson (D-N.M.) and Vice Chairman Carl Durham (D-N.C.) questioned the commissioners on their decision to require signed agreements before industrial personnel would be given the right to obtain licenses as provided in the new law.

Strangely enough, it was Rep Chet Holifield (D-Cal.) who stepped to their defense, explaining that it was his view that AEC must have full rein to check up on those who ask for restricted atomic data before issuing licenses. He received warm support from the AEC witnesses.

**Licensing Program . . .** Nichols said the licensing program which will follow on the heels of the agreements plan is now being processed at the commission. He said he has just approved procedures for licensing operators of atomic reactors, and that additional types of individual licenses will be approved within a few days.

A few days before it presented its new program to Congress, the commission released its 17th semiannual report. This also outlined some of the steps being taken to implement the new law. Some of the highlights of this document are:

• Industry will be called upon for its views in one or more conferences before AEC promulgates its new licensing procedures and regulations.

• A prototype boiling water reactor is proposed for completion in 1956 at Argonne National Laboratory. It will be a small plant, operating at a power of 20,000 kw and generating 5,000 kw of electricity. Allis-Chalmers Manufacturing Co is designing and building the plant, and installing generating, heat transfer and special power equipment.

• Design of a fast, large breeder reactor, capable of 15,000 kw, is going ahead at Argonne. A half-scale working model will go into initial operation there in March.

BRIG GEN SARNOFF, board chairman of RCA, is shown addressing AIEE general session

H. A. WINNE, retired GE official, is shown (second from right) receiving John Fritz Medal from T. G. LeClair. Onlookers are (l to r) President Monteith and Chairman Cooper

# Sarnoff, Monteith Address AIEE Parley

The Winter General Meeting of the American Institute of Electrical Engineers attracted more than 5,000 engineers of the organization's 50,000 membership. The meeting, biggest attendance-wise and in the number of sessions, was held Jan. 31-Feb. 4 at Hotel Statler in New York.

Highlighting the five-day agenda was the parley's only general session, which was held Jan. 31. This session was devoted to addresses delivered by AIEE Pres A. C. Monteith, vice president of Westinghouse Electric Corp, and Brig Gen David Sarnoff, board chairman of Radio Corp of America, and presentation of the John Scott Medal and institute prizes for best technical papers during the past year.

AIEE members also participated in 93 sessions and symposiums at which 400 papers on developments in all branches of the profession were presented and discussed. (A full report on the technical sessions will appear in the Feb. 21 issue of EW.)

**Medalists . . .** Presentation of three other major engineering honor awards also took place. The Edison Medal was presented by President Monteith to Oliver E. Buckley, retired president of the Bell Telephone Laboratories, Inc. Harry A. Winne, a retired vice president of General Electric Co, was given the John Fritz Medal by Titus G. LeClair, chairman of the John Fritz Medal Board of Awards. The Eta Kappa Nu Award went to Ruben Mettler of Hughes Aircraft Co.

In his talk before the general session, President Monteith commented on a scientific survey on member needs and an organization study, and unity organization goals.

**Institute Objectives . . .** To draw up forward-looking aims and objectives and accurately study members' wants, Monteith disclosed that AIEE is giving consideration to these two moves: First, conduct a scientific survey to secure a feeling of what our members are looking for. Second, based on survey results, build an institute organization that can serve these interests.

President Monteith expressed the belief that the "most important project" before the engineering societies today is to work toward a "unity organization" with a much broader base than now accomplished.

After commenting on several "unity" plans, Monteith told the general session "that your representatives are still pressing for a plan of evolution of Engineers Joint Council that would give it increased professional stature. We will keep you advised from time to time on our progress . . ."

**Technical Paper Awards . . .** President Monteith called on W. R. Brownlee, chairman of the Committee on Prize Awards, to present awards to the 17 electrical engineers and two student engineers for best technical papers.

Dr Marvin Camras, senior physicist of the Armour Research Foundation, was presented the John Scott Medal.

New electronic developments of great promise for the future were revealed by General Sarnoff. With the aid of films, the RCA official described these developments: a music synthesizer, a cooling system, a light amplifier, and a magnetic tape record for television and motion pictures.

**'Electronic' Refrigerator . . .** In describing the electronic air conditioner, designed without any moving parts, motors or compressors, General Sarnoff said it is believed to be the first refrigerator to achieve practical storage and freezing temperatures entirely by electronic means.

Sarnoff prefaced his closing remarks by expressing these viewpoints: "You may wonder what philosophy prompts me to reveal these new developments publicly while they are still in the experimental stage. My answer is simple. Competition can be as stimulating in research as in manufacturing and merchandising.

## Arkansas Accord

### AP&L, co-ops reach compromise agreement on bill to permit co-ops to build plant

Arkansas Power & Light Co and rural electric cooperatives took a big stride last week toward ending the sniping war of the past. They reached a compromise agreement on legislation designed to permit the co-ops to build generating plants. Satisfactory to both sides, the compromise deals with the disposal of surplus power.

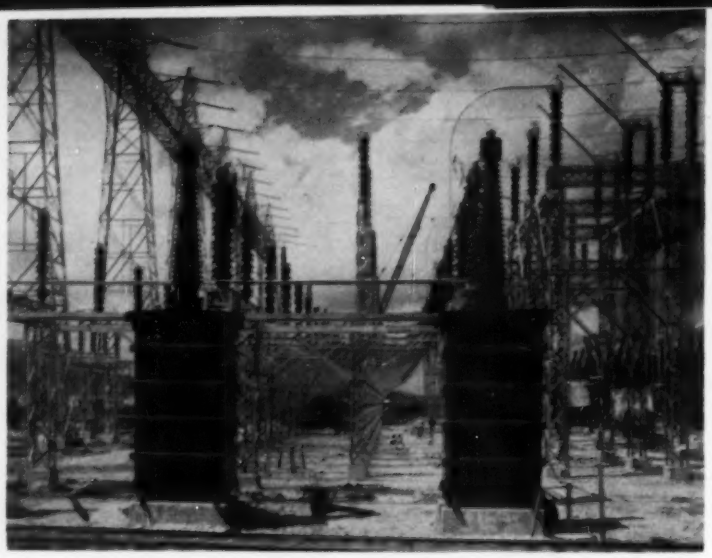
The agreement provides that if any power is sold to Southwestern Power Administration, SPA can resell it only to its list of preferred customers; if any power is sold to any other party, that party must use it in its own service territory. AP&L said this was designed to protect its rights and territory.

The co-ops are happy over the arrangement and say they might now build a 100,000-kw plant, as suggested to them by AP&L, instead of the original 30,000-kw Ozark plant that had been planned. This was the plant the courts had ruled against under existing laws.

**House Had Passed Measure . . .** The compromise came after the House had passed the bill (HB 76) by 90 to 0, and at a Senate committee hearing. The strength shown in the House by co-ops was surprising.

This session of the General Assembly has been a fractious and unpredictable one. Several bills unfavorable to private utilities have been approved in one house or the other. One reason for this is believed to be the prolonged hearings last year over rate increases by AP&L and Arkansas Louisiana Gas Co during the general election campaigns. The companies, as provided by law, put the higher rates into effect under bond before approval by the Public Service Commission.

One of the measures, passed 71 to 16 by the House, would amend the law defining rural areas to include cities or towns with 2,500 or less population and keep co-ops from being ousted from such territory in event the community is enlarged. This stemmed from the fight between AP&L and a Jackson County co-op a year ago over right to serve an area near Newport.



## Ohio Substation Is Among Largest

Substation pictured above is one of two under construction in southern Ohio which will contain 114 330-kv air switches and many power circuit breakers of 25 million kva interrupting capacity. Reported to be among the largest and highest voltage outdoor substations ever built, these two will be rated 1.3 million and 1 million kva, respectively.

Photograph shows a portion of one station, with two potential transformers in the foreground. The 330-kv, 1,600-amp switches on 17-ft structures at the right provide a breaking distance on 11 ft, but counterbalance springs permit easy manual operation. Aluminum tubing is used for connections to cut weight and stress on bushings. Steel line towers are 121 ft high.

Each station will occupy approximately 13 acres and require 800 tons of steel. Bus and switch insulators exceed 6,000 units and upwards of 4,000 strain insulators are used in the strings.

**Advertising Costs Attacked . . .** Another House-approved measure (61 to 28) would deny utilities the right to claim public relations and advertising expenses as valid costs in rate increase applications.

The Senate passed by 29 to 6 a proposal requiring utilities to wait 120 days after applying for a rate increase before they could post bond and put the increase into effect. At present the period is 30 days.

## Patent Rights Change in Atomic Law Sought

Rep W. Sterling Cole (R-N. Y.), former chairman of Joint Atomic Energy Committee, is once again leading a move to grant normal patent rights in the atomic field.

Cole tried last year to have this written into the 1954 revision of the Atomic Energy Act of 1946. He failed. But he did get fellow members, Republican and Democratic alike, to agree that patents would be the first order of business when the Joint Committee met this session—regardless of the outcome of the November elections.

On this condition, he went along with the "compromise" to limit compulsory licensing of atomic patents to a period of five years.

Democrats, led by Rep Chet Holifield (D-Calif.), had insisted on compulsory licensing for ten years, but they too joined in the compromise, promising action again this session to put their viewpoint across.

Cole has introduced a bill (HR 1777) to repeal the section of the new atomic law providing for five-year compulsory licensing. No Democrat has yet sponsored contradictory legislation. But, when one does, it is believed it will stand a far better chance of passage than the bill introduced by Cole.

## Line Relocation

### Survey shows costs to utilities of moving facilities when new roads are built

Electric power companies have long fought to get the government to foot the bill when new road construction requires uprooting of transmission lines and other utilities equipment. They haven't done too well to date.

Now, the Administration is proposing a gigantic new road-building program. Utilities relocation costs, as a result, will take a staggering jump.

**Survey on Costs . . .** A survey just made of relocation costs due to highway construction in 1953 shows that electric utilities had to pay almost $8 million to move their equipment to let new roads go through (see table). Of this, they got back only about $600,000, paid by state and federal governments.

Electric utilities were forced to pay more than 30% of total utilities relocation costs in 1953. Another one-third was paid by telephone companies, and the rest by telegraph, water, sewer, gas, pipeline, transit and other utilities systems. Total relocation costs, nationally, during 1953 were $20.9 million.

### Cost of Relocating Lines to Electric Utilities in '53

(Thousands of Dollars)

| | | | | | |
|---|---|---|---|---|---|
| Alabama | $ 67 | Massachusetts | $ 89 | Pennsylvania | $ 447 |
| Arizona | 8 | Michigan | 61 | Rhode Island | 4 |
| Arkansas | 190 | Minnesota | 215 | South Carolina | 6 |
| California | 612 | Mississippi | 17 | South Dakota | 10 |
| Colorado | 37 | Missouri | 167 | Tennessee | 133 |
| Connecticut | 41 | Montana | 4 | Texas | 263 |
| Delaware | 93 | Nebraska | 40 | Utah | 36 |
| Florida | 169 | Nevada | 6 | Vermont | 29 |
| Georgia | 14 | New Hampshire | 107 | Virginia | 26 |
| Idaho | 33 | New Jersey | 216 | Washington | 84 |
| Illinois | 895 | New Mexico | 15 | West Virginia | 65 |
| Indiana | 177 | New York | 855 | Wisconsin | 275 |
| Iowa | 31 | North Carolina | 108 | Wyoming | — |
| Kansas | 35 | North Dakota | 107 | District of Columbia | 7 |
| Kentucky | 94 | Ohio | 1,400 | Hawaii | 39 |
| Louisiana | 20 | Oklahoma | 31 | Puerto Rico | — |
| Maine | — | Oregon | 58 | *Total | $7,699,218 |
| Maryland | 236 | | | | |

*Parts do not add to total due to rounding.

**Recommendation Awaited . . .** What the Bureau of Public Roads would recommend in the way of federal reimbursement for relocation costs was not known as Electrical World went to press. BPR was sitting tight on its recommendations concerning this portion of the new highway program. It may be the agency will face up to the fact that an increase in relocation outlays by utilities would force some smaller companies into bankruptcy.

Here are some of the arguments presented by utilities in favor of reimbursement for line relocation:

- Costs of relocating lines and equipment due to roadbuilding are passed on to the consumers, who now pay a share of federal tax dollar.
- Utilities have a right to occupy the right-of-way. The courts have ruled utilities have a right to build facilities in public rights-of-way, and, under legislative sanction, to continue to use it as a property right.

**Contributions Are Small . . .** Trouble with the present law is this: The federal government contributes to utilities for relocation costs only when a state law requires the state to do likewise. If a state law does not make it mandatory on the state to reimburse, federal money is also withheld.

# WASHINGTON CHECKLIST

**Walter E. Blomgren,** assistant chief engineer of the Bureau of Reclamation at Denver since 1949, resigned last week (Jan. 31). He will become an engineering consultant.

**Federal Power Commission** has decided against amending its regulations to prescribe the effective date and term of licenses for projects built and operated prior to Jan. 1, 1938 without prior federal authority. The amendment would have set the effective date of such licenses as of the date on which FPC first gave notice to the project owner to file for a license. Under present rules, FPC usually makes licenses effective as of Jan. 1, 1938, for up to 50 years from the date of initial operation.

**The House Banking Committee** starts hearings Feb. 28 on a bill by Rep Spence (D-Ky) to bring bank holding companies under strict federal regulation and make them get rid of their holdings in other types of businesses.

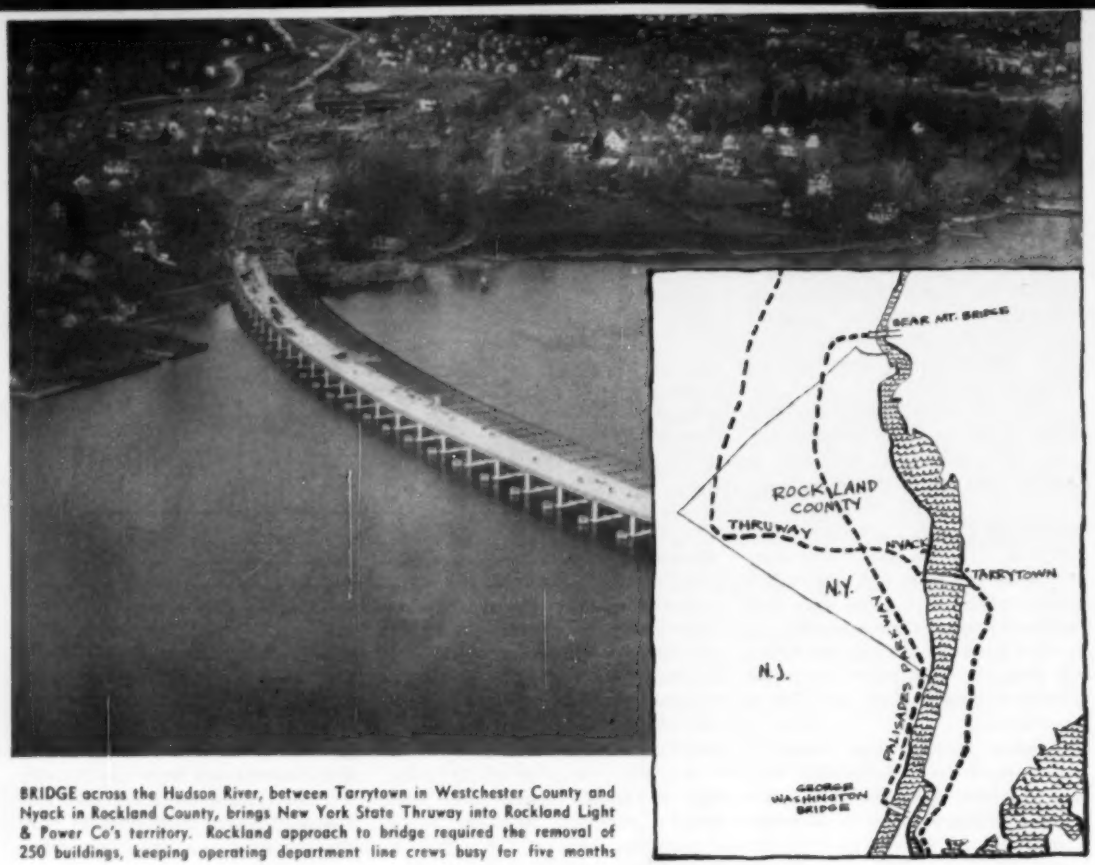
**Utilities investigations**—Senate Rules Committee has approved a request of the interstate commerce committee for $22,000 to finance a comprehensive investigation of the gas and electric utility industries and their regulation by FPC. Sen Warren Magnuson (D-Wash.) heads the commerce committee.

**Appropriations**—The House Appropriations Committee upholds Chairman Cannon's "packing" of the public works subcommittee. Senate appropriations committee Chairman Carl Hayden (D-Ariz.) is reported prepared to realign his unit to correspond.

## BILLS INTRODUCED

**New Steam Plants**—To explore the possibility of building a standby whenever use of hydro facilities of Norfolk and Bull Shoals would impair recreation facilities. (HJRes 165) Brazos River bonds—to authorize federal purchase to finance additional multipurpose development of the river. (HR 2819, HR 2873).

**Labor Disputes**—To reserve to certain state agencies and courts jurisdiction over disputes involving utilities. Atomic patents—to repeal the five-year compulsory licensing period on atomic patents. (HR 1777).




**BRIDGE** across the Hudson River, between Tarrytown in Westchester County and Nyack in Rockland County, brings New York State Thruway into Rockland Light & Power Co's territory. Rockland approach to bridge required the removal of 250 buildings, keeping operating department line crews busy for five months

# Rockland L&P Rebuilds Its System . . .

## . . . to clear the way for the highroads of tomorrow. Company meets problems created by construction of Thruway and Interstate Parkway in its area

When the superhighways come they promise big territory growth, but first they bring problems for a utility.

Experiencing this in a large dose today is Rockland Light & Power Co whose Rockland County territory is the scene of intense highway construction activity. Here the New York State Thruway and the Palisades Interstate Parkway are nearing completion. These major construction ventures have required the relocation of transmission and distribution lines and the removal or relocation of many buildings.

Rockland County is the most populous county and the heart of the service area of Rockland L&P. The company provides electric service to 48,371 customers in 32 communities in Rockland, Orange, and Sullivan Counties, N. Y., and gas service to 30,209 customers. Through subsidiaries in adjacent New Jersey and Pennsylvania territory, it serves another 19,348 electric and 494 gas customers.

The Thruway crosses about 20 miles in Rockland County. Within this distance three different engineering firms were retained by the New York State Thruway Authority to design, plan, and supervise the construction of respective sections.

The first consideration for Rockland L&P was to redesign transmission and distribution plant facilities to clear Thruway construction. In conformance with certain Thruway rules only transmission lines were allowed to cross the Thruway right of way overhead. The minimum clearance had to be 30 ft from the lowest conductor to the finished pavement of the Thruway. Some lines operate at 34.5 kv and others at 69 kv.

Distribution crossings of the Thruway right of way were in concrete-encased non-metallic duct lines installed in either underground trenches or in the bridge decks of the respective crossings. This required duct line construction of the distribution system of 2,400/4,160 Y voltage.

Because the tremendous depth of some of the fills required by Thruway construction make it virtually impossible to reconstruct or add to the num-

THIS area, south of Hillburn, was scene of intense activity. Relocation of transmission lines and a river involved the removal and replacement of 20 steel towers

MUD wave set up in swamp by Thruway earth fill, right, caused delay in raising steel transmission line towers. Work was delayed to allow sufficient time for fill and swamp to become static

ber of ducts in such a location, it became necessary to make a long-range growth study to determine how many spare ducts future growth might require. Another thought always to be kept in mind was that the highway would increase the rate of real estate development and thus the load growth to the company.

Rockland L&P engineers began working on these problems in the summer of 1952 in consultation with the engineers retained by the Thruway. The work required a large proportion of the company's engineering department numbering eight engineers, three draftsmen, and two stenographers as well as personnel from the operating department. As plans, specifications, and cost estimates for each of the many projects were completed, they were presented to each of the Thruway engineering consultants for inclusion in the over-all contract plans.

The Thruway enters Rockland L&P territory after crossing the Hudson River below Nyack. From here Madigan-Hyland, consulting engineers, had responsibility for about 1.5 miles of the construction. This section runs through the villages of Grand View, South Nyack, and Nyack. No transmission changes were required but five underground crossings had to be built. About 250 buildings had to be removed. The clearings of space here for a vast interchange between the Thruway and Route 9W also necessitated removal of 150 poles supporting the existing overhead distribution and street lighting systems together with service connections from poles to buildings.

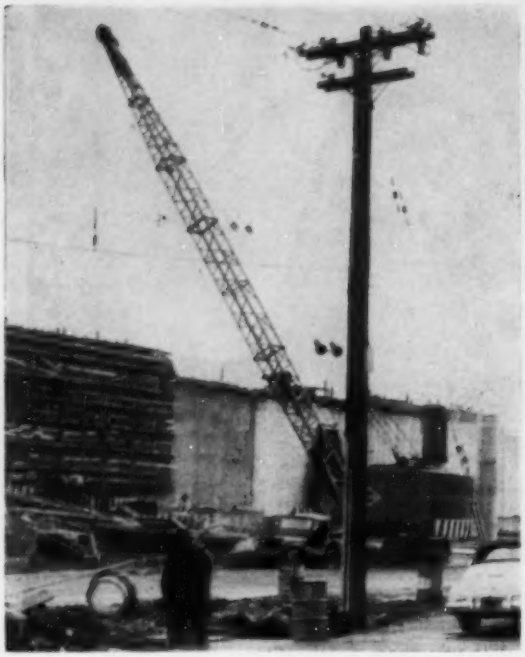
About 60 of the 250 buildings were moved to new locations. This required operating department line crews to elevate overhead wires to clear the moving operation and to lower them after each house had been moved. The cost was borne by the property owner. As many as three line crews were tied up at one time during the house moving operations which lasted for five months.

The next westerly section, 14.5 miles, is under the control of Parsons, Brinckerhoff, Hall & MacDonald, consulting engineers. Passing through Clarkstown and Ramapo townships and by-passing other villages, it required removal of few buildings.

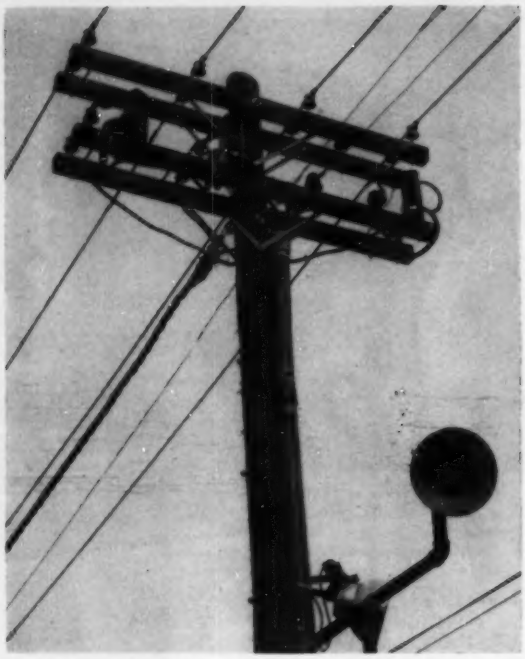
Three 34.5-kv transmission lines had to be elevated to provide adequate clearance. The work involved raising three double circuit steel towers and constructing one new steel tower. The towers to be raised were first dismantled, grillages excavated and reset, and new body extensions together with the original tower body erected to provide the required additional height.

Two of the raised towers were on either side of the Thruway where a fill of 32 ft was required. This fill was placed in a swamp area and as the depth of the fill increased, its weight produced a transverse movement or mud wave in the upper section of the adjacent swamp. This posed a considerable problem for the contractor as the relocated grillages could not be stabilized until all the fill was in place. The original concept of this job was predicated on the thought that it would be possible to complete the tower reconstruction and line work before the total fill for the Thruway was in place.

On this premise a double circuit wood pole by-pass was constructed with only sufficient clearance over the



THIS is typical deadend distribution pole technique to carry lines under Thruway. Duct risers on pole include one for telephone lines



TYPICAL DEADEND POLE construction called for cable supporter to carry weight of cable with conduit carried down in fiber duct

# Thruway rules called for raising number of transmission

original swamp elevation to provide for access roads and preliminary fill placement. Because of difficulties encountered, it became necessary to reconstruct the temporary wood pole bypass and provide sufficient height so that the entire depth of fill could be placed. This allowed sufficient time for both the fill and the adjacent swamp material to become static.

In this section there were 22 distribution crossings of which 19 required underground construction and three required relocation of existing overhead construction.

In a few cases where the Thruway passed over existing highways, it was possible to construct underground crossings and remove the overhead distribution prior to actual construction. In other cases, because of bridge construction and proximity to proposed underground duct lines and existing overhead wires, it was necessary to build temporary by-passes.

Some of the most difficult reconstruction was on the third and last section from Suffern to the Rockland-Orange County line. This was under the control of Clarke & Rapuano, consulting engineers. Nine transmission circuits terminate in the substation here and seven of these had to be relocated. North of Hillburn three circuits were relocated, and south of Hillburn another four had to be moved. Altogether this involved removal of 20 steel towers, construction of 20 others, reconstruction of two towers from salvaged material, and use of several new wood poles. Existing copper conductors, insulators, and hardware had to be removed and replaced.

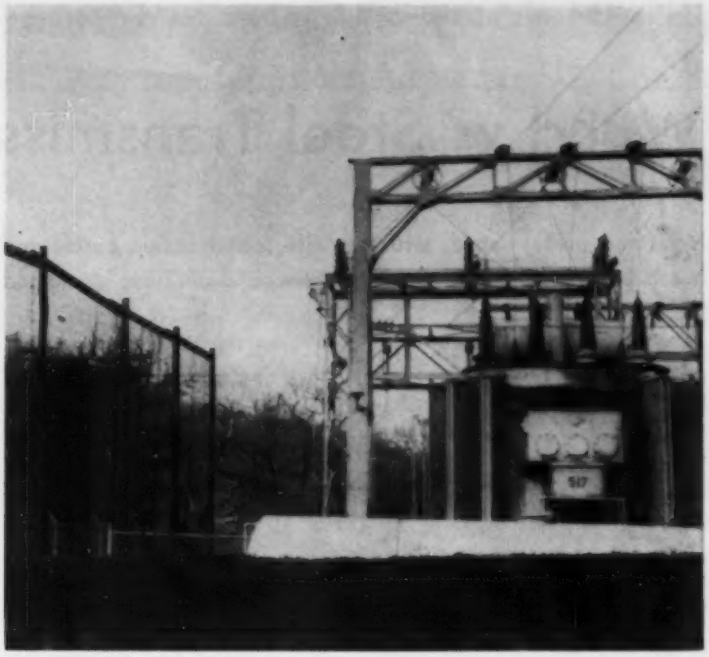
A feature of the intense activity of this area was the relocation of the Ramapo River for a distance of about a mile and the construction of three steel bridges. Rockland L&P's transmission facilities here were hit from time to time by crane booms which caused outages on transmission circuits for as long as 45 minutes.

The operation of cut-overs from existing to temporary and from temporary to relocated transmission line circuits in the Hillburn area was a considerable problem and required extremely close continuity of control between engineering staffs of Rockland L&P and the consulting engineers and other parties involved in the work. It was necessary for operating department line crews to be in the area to handle switching, transmit line clearance, etc, in this cut-over procedure.

At Sterlington, north of Hillburn, it was necessary to relocate three transmission line circuits, including two of 69-kv. The latter two, carried on double circuit steel towers, required relocation of five sections. One of the existing towers was rotated to provide the proper angular bisect. The whole operation involved dismantling and reerection of towers on new rights of way, plus installation of new towers. In Sloatsburg, a 34.5-kv line had to be relocated for about 1 mile, involving rotating one existing steel tower; removal of two steel towers and 26 existing wooden pole structures, both H and single pole; and installation of 17 new wood pole structures.

Construction of new underground distribution and street lighting sections followed a more or less general pattern. Duct lines were formed by using fiber or cement asbestos conduit laid in a concrete envelope except in cases where a particular duct line passed through the abutment walls of a bridge into adjacent earth fill where vertical

TEN FEET from ground conduit enters galvanized sheath ending in concrete envelope



HILLBURN SUBSTATION, adjacent to Hillburn generating station, was unintended target of flying rock from extensive blasting operations. Wire screen at left shielded the equipment

## lines, and for underground crossing of distribution lines

sheering stresses might be developed. In these cases galvanized conduit was used.

At the end of each respective underground conduit section, as the conduit approached the terminal pole structure, a 10-ft length of galvanized conduit was introduced and concreted in for about half its length. This provided for slight flexibility in the duct lines at these points which will facilitate replacement of terminal poles in the future.

Maximum number of duct risers terminating on a pole was held to three, including one for telephone. The minimum number of ducts per crossing was four for Rockland L&P and two for telephone. Maximum distance between manholes was held to about 400 ft, and from manhole to terminal pole to about 150 ft. In most cases both electric and telephone underground duct line manholes were installed side-by-side and were almost exclusively of pre-cast concrete.

Distribution voltages being 2,400/-4,160 Y, a 5,000-v single conductor, ozone resistant, rubber insulation, Neoprene-sheathed, non-shielded cable of appropriate size was used. Terminal pole risers were of galvanized iron conduit, rising 10 ft above ground. The conduit was carried up the pole in fiber duct terminating in a cable supporter to carry the weight of the cable. The cable was then continued into porcelain-housed disconnecting switches with lightning arrestors installed on the end of each cable.

To avoid having to hire supplemental crews and tieing up existing crews at the expense of normal maintenance and new business, Rockland L&P reached a special agreement with the Thruway Authority. All utility reconstruction required by the Thruway was included in the over-all contract handled by the respective consultants. This meant that Rockland L&P's out-of-pocket expenses would have to cover only the salaries and expenses of supervisory and engineering personnel. This constituted only a small proportion of the total cost of Rockland L&P reconstruction. In a few isolated cases, the company acted as a sub-contractor for the State of New York where it was impractical to include relocation of utility facilities in the Thruway contracts.

The construction of the Palisades Interstate Parkway also called for reconstruction of transmission and distribution plant facilities along its right of way at several locations. Here the state is furnishing, at no cost to the company, the underground system of duct lines and manholes. The company is defraying the cost of purchase and installation of the cable, together with the required terminal poles and overhead line changes, by-passes, etc. The company's engineers provided the engineering design for the underground installations.

The impact of these highways on the company's territory is expected to be considerable. Projected for the future are extensions of the New Jersey Turnpike and the New Jersey Garden State Parkway to connect with the Thruway in Rockland County. From nearby points links will be made with the parkways to New England. Rockland County thus becomes a major crossroads. And the new superhighways place the county 30-45 minutes from New York's Times Square. The turmoil of highway construction promises to pass into the turmoil of rapid territory growth, matching, if not surpassing that of Long Island.

Up to 45 years of service life is basis for comparing . . .

# Wood vs Steel Transmission Lines

## Lightning performance, structure life, construction costs, and operation of 34 PS of Colorado transmission lines discussed

**LAWRENCE M. ROBERTSON**, Chief Electrical Engineer, Public Service Co of Colorado, Denver, Colo.

In designing a transmission line, the choice between wood poles and steel construction is influenced by performance, service life, and costs. Local factors frequently favor one construction over the other. In most situations, however, a wood pole line offers better lightning performance and involves smaller costs while the life of steel structures is somewhat longer.

Public Service Co of Colorado has had from 1 to 45 years' experience with both wood and steel construction on 34 transmission lines, ranging in voltage from 44 to 115 kv. The territory it serves embraces urban and farm areas at 5,000-ft altitude, prairies, and mountains as high as 13,525 ft. Over this area tower footing resistances range from a very few to 1,500 ohms. Individual tower resistances change from year to year and during each year with the amount of precipitation. The isokeraunic level for all lines is about 50 storm-days per year.

**General Conclusions . . .** Based on this utility's experience, the following general conclusions are offered:

**1.** Wood pole H-frame lines with two overhead ground wires have an excellent record of freedom from lightning trip-outs. They are practically lightning proof.

**2.** Wood and steel lines with one ground wire have about the same record of lightning trip-outs per 100 miles of line per year.

**3.** Wood lines with ground-fault neutralizer protection have slightly better lightning performance than do steel lines.

**4.** Lines with one ground wire have about the same lightning performance record as those with ground-fault neutralizers.

**5.** Lines with no protection have a very poor record. Unprotected wood construction shows up better than steel.

**6.** Expulsion protector tubes near the top phase of a single wood pole construction with triangular configuration for 44 and 69 kv appear to give good results.

**7.** Wood construction generally costs less, particularly in the mountains.

**8.** Full-length treatment of arms and poles is fully justified.

**9.** Galvanized steel structures are in good condition after 45 years of service.

**Factors Considered . . .** Voltage, conductor size, whether a single or double circuit, required lightning performance, contamination and bird problems, right-of-way procurement and maintenance, and the method and time of construction have been considered in arriving at these general conclusions. Furthermore, the character of lightning storms, ground conditions, and climate have been studied in their bearing on performance, life, and cost of a particular line.

Dimensions and general arrangement of the lines considered are illustrated in Fig 1 through 10. The single-pole wood lines in Figs 1 and 2 are 44 and 69 kv. Insulators are rated 55 kv and mounted on steel pins. Although steel crossarm braces were used in early construction, crossarm and pole burning prompted their replacement by wood braces. The wood braces on all lines eliminated the trouble except where there was very severe contamination.

**Table I—Average Trip-Outs from Lightning Per 100 Miles Per Year**

| Construction and protection | Trip-outs |
|---|---|
| Wood —No ground wire | 12.8 |
| Steel —No ground wire | 21.1 |
| Wood —Ground fault neutralizer | 5.3 |
| Steel —Ground fault neutralizer | 6.7 |
| Wood —One ground wire | 7.0 |
| Steel —One ground wire | 6.5 |
| Wood —Two ground wires | 0 |

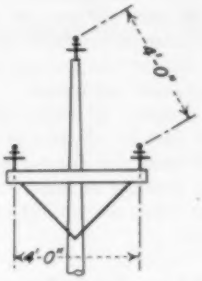
**Protector Tubes Cut Damage . . .** One 69-kv line had a fairly large number of trip-outs and pole splinterings. A trial installation of expulsion protector tubes was made in May, 1953, on 15 poles where damage had been most frequent. During the following summer, 20 poles were hit by lightning, as indicated by splintered poles or targets on the tubes and magnetic surge-crest ammeter links on tube ground wires. Of these, 11 poles equipped with tubes showed no damage, and nine poles without tubes were splintered by lightning with six accompanying trip-outs. Adjacent poles were hit in some instances, probably by the same strokes. The use of a few expulsion tubes in this 109.58 miles of line apparently had been beneficial.

A four-mile section of the 44-kv loop, Fig 3, is of steel pole construction, with one overhead ground wire, 69-kv pin-type insulators on steel pins, steel crossarms, and steel braces. Considerable trouble was experienced with both birds and lightning flashovers. When crossarms and braces were changed to wood, as shown in Fig 4, the difficulties ceased.

**Ground Wires Removed . . .** Steel tower construction used for Shoshone-Denver and Boulder Canyon-Denver 115-kv lines is illustrated in Fig 5. These lines were built in 1909 with two ground wires attached rigidly to the arm at a point above the leg angles. After crystallization breaks occurred, the ground wires were removed. Insulation, consisting of four 10-in. insulators in suspension and

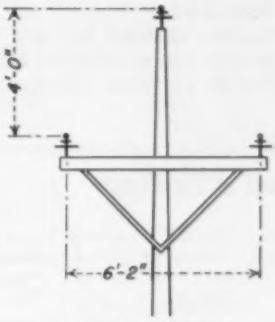
(*Continued on page* 68)

# No Single Construction Type Meets All Needs



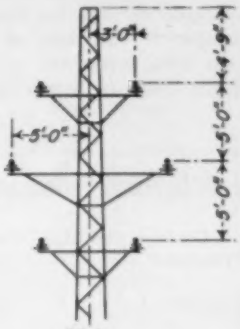

44-kv Loop

Fig 1

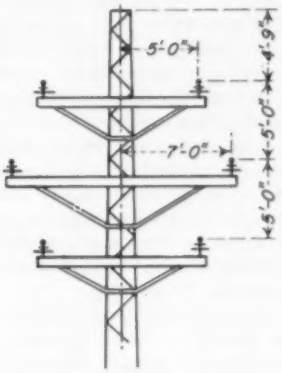



44-kv and 69-kv

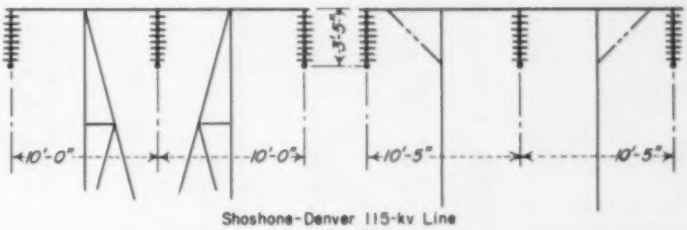
Fig 2



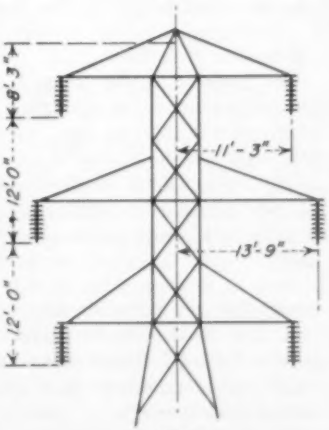

44-kv
Steel Arms, Steel Braces
Fig 3



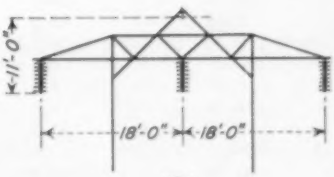

44 kv
Wood Arms, Wood Braces
Fig 4



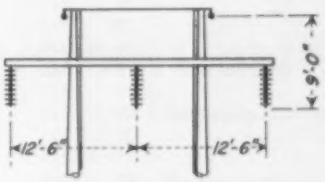

Shoshone-Denver 115-kv Line
Fig 5



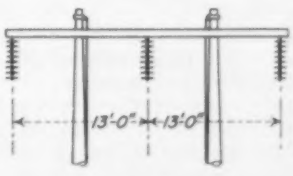

115 kv
Fig 6



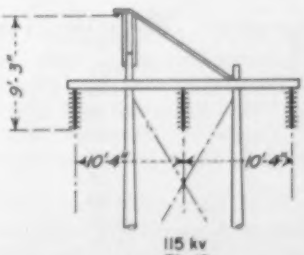

115 kv
Fig 7




115 kv
Fig 8




115 kv
Fig 9




115 kv
Fig 10

## Wood vs Steel

(*Continued from page 66*)

five at deadends, was found inadequate; so one insulator was added.

A program of replacing insulators and conductors with those of larger size has been prosecuted with the result that towers no longer can support ground wires. A ground-fault neutralizer, however, was installed on the Shoshone-Denver system in 1936. For these lines in mountainous territory, buried, continuous counterpoise has been added.

Structures illustrated in Figs 6 and 7 are steel towers; those in Figs 8 through 10 are wood. No overhead ground wires have been provided on the frames of Fig 9 although some scattered expulsion protector tubes were added on one line.

Table I summarizes the average number of trip-outs due to lightning per 100 miles per year for wood and steel construction with no ground wire, one or two ground wires, and ground-fault neutralizer. Averages were obtained by adding all outages for all lines for all years in each class and dividing this number by the sum of the products of hundreds of miles of line times the number of years of record.

### Table II—Lightning Performance of 34 Wood or Steel Lines

| Type of Construction and Protection | Line | Voltage Kv | Figure Number | Length Miles | Years of Service | Trip-Outs /100 miles /Year |
|---|---|---|---|---|---|---|
| Wood–No ground wire | 1 | 44 | 1 | 153.20 | 19 | 12.4 |
| | | | | 126.00 | 9 | 20.7 |
| | 2 | 44 | 2 | 40.70 | 12 | 12.3 |
| | 3A | 44 | 2 | 64.93 | 10 | 5.7 |
| | 3B | 44 | 2 | 100.33 | 10 | 17.5 |
| | 3C | 69 | 2 | 100.52 | 1 | 8.0 |
| | 3D | 69 | 2 | 109.58 | 2 | 6.8 |
| | 4 | 44 | 2 | 35.22 | 11 | 9.3 |
| | 5A | 44 | 2 | 86.32 | 5 | 7.1 |
| | 5B | 69 | 2 | 86.32 | 3 | 9.2 |
| | 6 | 69 | 2 | 101.12 | 4 | 10.1 |
| | 7 | 115 | 9 | 30.39 | 7 | 21.1 |
| | 8 | 115 | 9 | 26.80 | 21 | 16.3 |
| | 9 | 115 | 9 | 35.67 | 2 | 21.0 |
| | 10 | 115 | 9 | 23.10 | 11 | 16.1 |
| | 11 | 115 | 9 | 26.34 | 2 | 3.8 |
| Wood–Grd-fault neut | 12 | 115 | 9 | 30.39 | 16 | 5.4 |
| | 13 | 115 | 9 | 57.04 | 2 | 5.3 |
| Wood–one ground wire | 14 | 115 | 10 | 25.79 | 5 | 7.0 |
| Wood–two ground wires | 15 | 115 | 8 | 5.40 | 3 | 0 |
| | 16 | 115 | 8 | 9.90 | 6 | 0 |
| | 17 | 115 | 8 | 14.00 | 7 | 0 |
| Steel–No ground wire | 18 | 115 | 5 | 155.53 | 4 | 29.3 |
| | 19 | 115 | 5 | 63.46 | 7 | 16.0 |
| | 20 | 115 | 5 | 92.07 | 7 | 20.9 |
| | 21 | 115 | 6 | 23.01 | 4 | 34.8 |
| | 22 | 115 | 7 | 7.76 | 4 | 19.3 |
| | 23 | 115 | 5 | 29.58 | 28 | 16.3 |
| Steel–Grd-fault neut | 24 | 115 | 5 | 63.46 | 17 | 8.6 |
| | 25 | 115 | 5 | 92.07 | 16 | 5.4 |
| Steel–One ground wire | 26 | 115 | 6 | 23.01 | 24 | 5.8 |
| | 27 | 115 | 7 | 7.76 | 24 | 11.3 |
| | 28 | 115 | 6 | 4.54 | 2 | 0 |
| | 29 | 115 | 6 | 35.78 | 2 | 1.4 |
| | 30 | 115 | 6 | 22.60 | 2 | 4.4 |

**Wood Lines Appear Better . . .** Data in Table I seem to indicate little difference between steel and wood lines when one ground wire is used. Performance of wood lines appears better than steel where there are no ground wires and ground-fault neutralizer. Lines with ground-fault neutralizer have about the same performance as those with one ground wire.

Inspection of the complete data does not seem to confirm an earlier surmise that some self-extinguishing effect of the arcs along wood might be present. Nevertheless, there has been very little splitting of wood poles and arms attributable to lightning.

Data on each of 34 lines covering the period for which information is available are given in Table II. Time intervals are from 1 to 26 years. Distinctions among types of protection are included because experience has shown that they make quite a difference in line performance. Complete data on each line, year-by-year, show a wide variation in the number of trip-outs for each line.

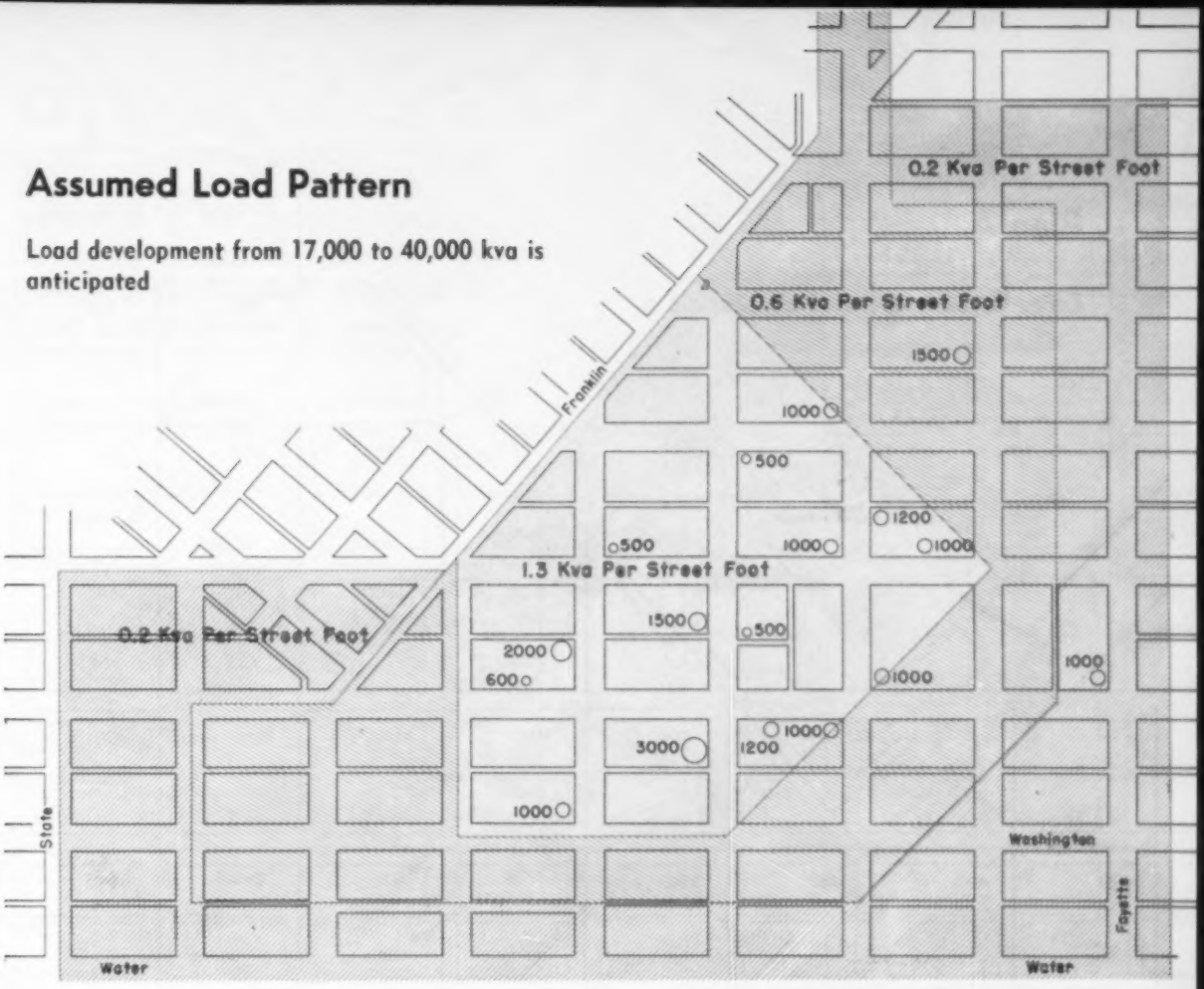
This variation is due, in part, to some differences in the same type of construction in different lines. Variation might also be accounted for by different geographical locations, such as open prairie or mountainous terrain, and the corresponding exposure level.

### Table III—Service Life of Structures Is Encouraging

| Construction | Miles of Line | Years of Service | Comments |
|---|---|---|---|
| Steel | 185.11 | 43 | No replacement |
| | 30.77 | 28 | " |
| | 20.10 | 2 | " |
| Wood | 126.00 | — | Replaced in 30 to 40 years |
| | 105.63 | 26 | No replacement |
| | 35.22 | 25 | " |
| | 30.39 | 24 | " |
| | 54.00 | 22 | " |
| | 86.50 | 11 | " |
| | 14.00 | 5 | " |
| | 24.70 | 4 | " |
| | 23.90 | 2 | " |

**Service Life . . .** Actual service life of steel and wood pole structures is given in Table III. There were no replacements of galvanized steel structures in lines from 2 to 45 years old. Although there are a few locations having some atmospheric contamination, it has not been a problem. Tower footings are of grillage construction.

(*Continued on page 146*)




# 277/480-V Network Cuts System Costs

**E. ROTHFUS, J. R. OBERHOLTZER,** Commonwealth Associates, Jackson, Mich.,

**W. R. FOLCK,** Central Illinois Light Co, Peoria, Ill.

Opportunities for savings as higher customer voltages become prevalent have prompted Central Illinois Light Co to plan development of its distribution system in the Peoria underground network area at 277/480 v.

According to the utility's estimates, the basic system cost at 277/480 v when autotransformers for providing other than network voltage are not considered would be about 80% of the 120/208-v network cost. Other savings are possible in operation and maintenance because the higher voltage system needs fewer transformers, vaults, and secondary cables and shorter primary cables.

CILCO was also influenced by possible benefits to large customers in the form of reduced wiring costs.

The utility studied four plans for the area. Investment requirements, given in Table I, were estimated for a cost comparison of these plans when serving a total future load of about 40,000 kva, distributed as illustrated. Load now is 17,000 kva.

While estimated future costs do not differ sufficiently to be the only basis for preferring any one plan, the 277/480-v network plan, cheapest of the four on the basis of serving the same loads, would enjoy further reductions in cost as customers wire to use the higher voltage. The decision to develop a network operating at 277/480 v was made with the understanding that spot service to large loads at other voltages would be provided through direct transformation from the primary.

Studies indicate that for new network installations the 277/480-v network offers definite cost advantages which are not necessarily realizable in a change from the existing 120/208-v network because of the expense of change-over and retirement of equipment.

The present underground distribution system in Peoria, population about 110,000, consists of radial 2.4/4.16-kv primaries supplied from several 14.4-2.4/4.16-kv substations and providing some secondary voltages through ad-

# CILCO Maps Peoria Underground Development

ditional transformation in building vaults. About 45% of the load is supplied at 120/208 v, single phase; 30% at 480 v, 3 ph; 22% at 120-208 v, 3 ph; and the remaining 3% at 240 v, 3 ph. The 1953 peak load in the underground area was about 17,000 kva, an average density of about 55,000 kva per sq. mile. Earlier engineering studies suggested the desirability of changing to a secondary network supplied directly at the 14.4-kv generator voltage.

**Four Plans Studied . . .** CILCO's detailed plans, including estimated costs, for serving a total load of about 40,000 kva were these:

Plan A—Entire network operated at 120/208 v, as shown above.

Plan B—Entire network operated at 277/480 v with autotransformers as required, as shown on page 71.

Plan C—General network at 120/208 v, but large loads served from spot networks at 277/480 v, as shown on page 72.

Plan D—General network at 277/480 v, but large loads served from spot networks either at 120/208 or 277/480 v, as shown on page 73.

The load pattern used as the basis for detailed network layout, p69, shows both distributed load growth and the development of spot loads. The latter include increases by present large individual users and the addition of new concentrated loads at random locations. Comparative layouts for other load patterns show

## Plan B

**Entire network operated at 277/480 v with autotransformers as required**

# *Costing 80% of 120/208-V Distribution Layout*

substantially the same cost relationships.

**Advantages . . .** Several factors are involved in a study of the two possible network voltages. Those favorable to a 277/480-v system are:

**1.** It provides a more economical supply voltage for large buildings with heavy loads remote from the service entrance.

**2.** It affords greater flexibility in the location of transformer vaults with respect to particular loads and results in generally improved regulation on the secondary.

**3.** Fewer vault locations are required.

**4.** Fewer secondary conductors simplify service connections.

**5.** Operating and maintenance time and expense are less because fewer equipment units and less cable are used.

**6.** The higher voltage results generally in better utilization of available duct space, particularly in service runs.

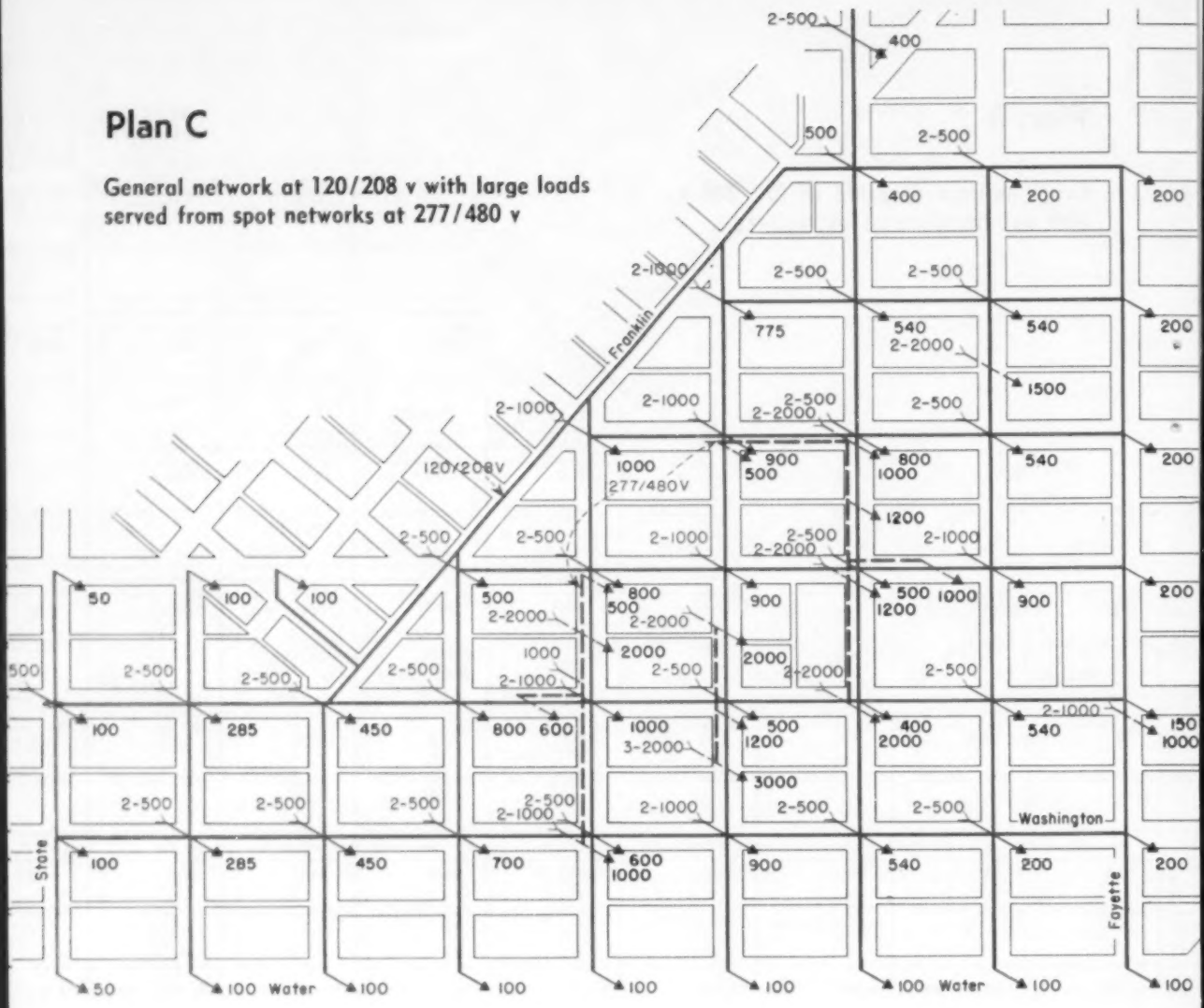
**7.** Existing 440-v equipment can be served without transformation.

**Disadvantages . . .** Factors unfavorable to 277/480 v are:

**1.** Autotransformers are needed to serve a large part of the load which is at voltages lower than 277/480-v. They should be located very close to the load, probably on the customer's premises. Securing adequate space

## Plan C

**General network at 120/208 v with large loads served from spot networks at 277/480 v**




# Savings in Operation and Maintenance Seen

may be a very difficult problem.

**2.** Fault kva is generally higher, and faults are not self-clearing necessitating greater care in the application of protective equipment.

**3.** The higher voltage requires somewhat more care in operation and maintenance.

**4.** Larger transformers are heavier and more difficult to handle. A 2,000-kva unit for 14.4-kv supply weighs 21,000 lb which is 40% heavier than a 1,000-kva unit.

**5.** Ideal vault spacing may not be obtainable because of the spacing of concentrated loads.

**6.** Existing 440-v starters have only two thermal elements.

**Problems with Each . . .** Service may be provided at lower voltages from 277/480-v secondaries by the use of either two-winding transformers or autotransformers (see page 74). Autotransformers for this application are not now being manufactured but may be ordered. Quoted prices indicate that their cost will be about half that of the two-winding types and that losses and physical space requirements will be lower. It has been proposed that autotransformers be used for this purpose as soon as they become available.

Throughout the underground area groups of several buildings are served from a single service point. In the development of the 277/480-v system, the service should be at 277/480 v,

## Plan D

**General network at 277/480 v with large loads served from spot networks at 120/208 v or 277/480 v**

# In Reduced Transformers, Vaults, Cables

3 ph, with 1-ph loads served from autotransformers balanced among the phases.

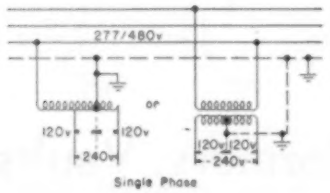
In general, faults on the secondary system would not be self-clearing at 277/480 v, so limiters for each cable section have been included in estimates. Available fault currents at building service entrances might be slightly higher at 277/480 v than at 120-208 v because of the smaller limiting effect of cable impedance. The price differential, nevertheless, is very small between high-capacity current-limiting fuses and mountings for customer's service equipment at these voltages. In many instances the difference may be favorable to the higher voltage because of the lower normal-load current.

**Long-Range Flexibility . . .** Particularly important is the superior long-range flexibility of the 277/480-v system design which permits serving more unforeseen spot-load developments from existing vaults and considerable latitude in the location of new vaults. Adequate equipment appears to be available for its safe and successful operation.

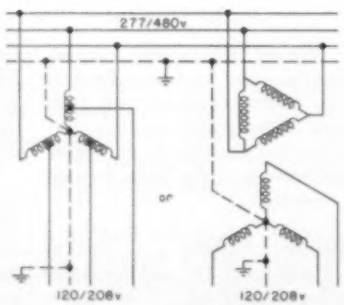
Experience gained as the plan develops should indicate the most advantageous arrangement of 277/480-v secondaries and most suitable location of autotransformers. Some studies indicate that more effective use of network transformers is attained in the 277/480-v system through the

## Table I—Future Investment Additions for Comparison of Plans to Supply 40,000 KVA

| | Plan A 120/208 V Network | Plan B 277/480 V Network | Plan C 120/208 V with 277/480 V Spots | Plan D 277/480 V with 120/208 V Spots |
|---|---|---|---|---|
| Substation | $300,000 | $300,000 | $300,000 | $300,000 |
| Network transformers | 1,234,000 | 845,000 | 1,301,000 | 1,062,000 |
| Autotransformers | 146,000 | 583,000 | ..... | 292,000 |
| Transformer vaults | 498,000 | 289,000 | 536,000 | 365,000 |
| Manholes | 245,000 | 245,000 | 245,000 | 245,000 |
| Ducts | 840,000 | 840,000 | 840,000 | 840,000 |
| Primary cable | 272,000 | 175,000 | 281,000 | 194,000 |
| Secondary cable | 556,000 | 397,000 | 532,000 | 397,000 |
| Limiters | 10,000 | 140,000 | 21,000 | 134,000 |
| Services | 220,000 | 160,000 | 220,000 | 160,000 |
| Meters | 100,000 | 60,000 | 85,000 | 75,000 |
| Total Plant Cost | $4,421,000 | $4,034,000 | $4,361,000 | $4,064,000 |
| **Rounded Total Cost** | $4,400,000 | $4,000,000 | $4,400,000 | $4,100,000 |
| Cost per kva | $109 | $99 | $109 | $101 |
| Cost per kva exclusive of autotransformer | $106 | $85 | $109 | $95 |
| No. of primary feeders | 8 | 8 | 8 | 8 |
| Primary feeder size—MCM | 350 | 350 | 350 | 350 |
| Secondary size—MCM | 500 | 500 | 500 | 500 |
| Network transformer kva rating | 3&4 per ph 500 & 1,000 | 2&3 per ph 1,000 & 2,000 | 3&4 per ph 500, 1,000 & 2,000 | 2&3 per ph 500, 1,000 & 2,000 |
| Total transformer kva | 66,000 | 59,000 | 72,000 | 65,000 |
| Ratio—Load transformer kva | 0.61 | 0.69 | 0.56 | 0.62 |
| Autotransformer kva | 16,250 | 65,000 | 0 | 32,500 |



Single Phase



Three Phase (4 wire)

**TWO-WINDING TRANSFORMERS** or autotransformers may be utilized in Peoria for serving loads at lower voltages from the 277/480-v network. Autotransformers should be located very close to the load, probably on the cutomer's premises

## Cuts System Costs

(*Continued from previous page*)

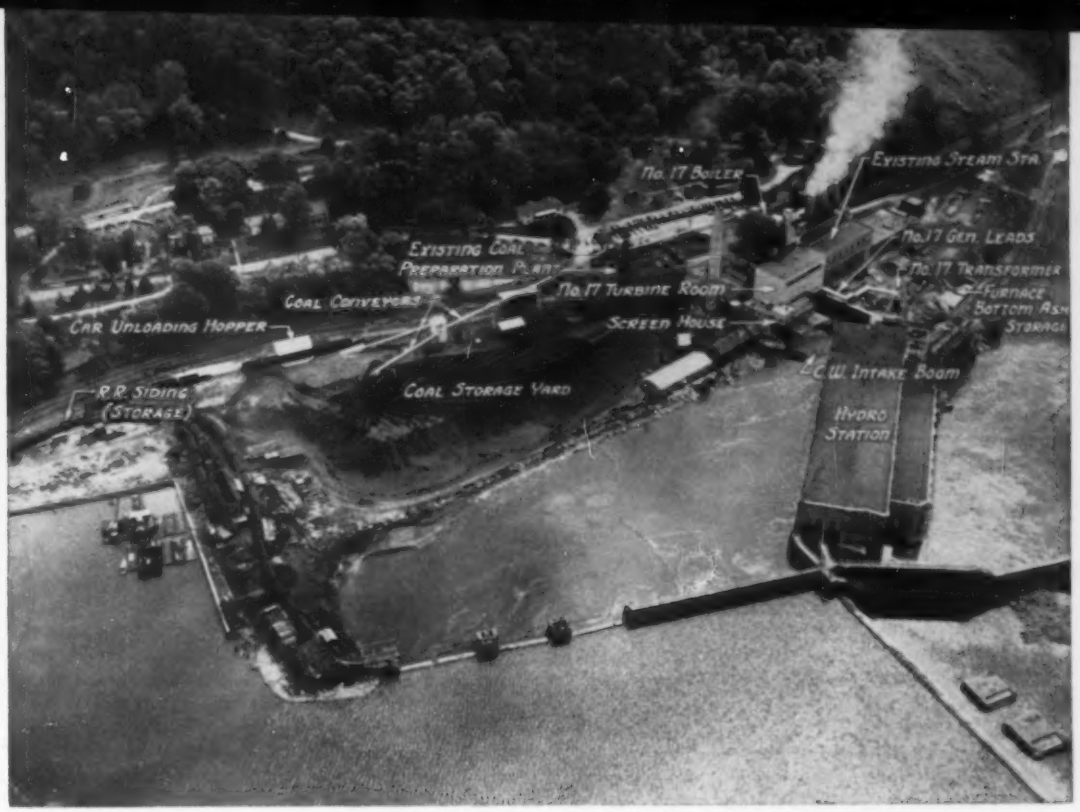
establishment of multi-transformer spot locations with loads served through multiple-conductor radial secondaries. This differs from the more usual network pattern with all transformer installations tied together through a heavy secondary grid. Investigation of this departure will continue until the company has sufficient data to reach a sound conclusion on its worth and effectiveness.

The value of the present underground installation, it appears, will be about the same regardless of the plan followed. Present manholes, ducts, and secondary cable will be most useful. It has been estimated that 80% of the manholes included in the cost tabulation will be available although many will need to be enlarged. Much of the duct system will be adequate during the early development, but considerable primary and secondary cable will be required. Later, as existing cable is released for incorporation into the network, new cable requirements will lessen. On the other hand, duct banks will become inadequate and will have to be either enlarged or replaced.

CILCO's exploration of the several plans for serving its customers in Peoria at higher voltages affords a pioneering example in this field for other utilities contemplating going to higher voltage to meet local exigencies and to obtain the available savings. With modifications to meet particular local circumstances, CILCO's four plans are adaptable to other cities with comparable networks, load densities, and commercial textures. The Illinois utility is continuing with its explorations in the field of higher voltages at the customer level.

### *Index is Available*

**Electrical World's semi-annual index for July-December 1954 has been prepared, and copies are now available upon request. They may be obtained without charge. Address requests to Electrical World, Editorial Office, 330 W. 42nd St., New York 36, N. Y.**




**20 Years' Anthracite Experience Guides Design of . . .**

# Holtwood's New River Coal Unit

**J. Q. WRAY, JR,** Asst Chief Engineer—Design, Pennsylvania Water & Power Co, Baltimore, Md.

**R. R. BENNETT,** Supervising Mechanical Engineer, Ebasco Services, Inc, New York, N. Y.

Among the outstanding features of Pennsylvania Water & Power Co's new 66-Mw, low-cost river-bottom anthracite-fired unit are:

- Largest anthracite steam generator in the United States.
- Semi-outdoor boiler design.
- Centralized control.
- 4,000-ft long fly ash slurry pipe line—250 psig.

For many years coal has been carried downstream from the Pennsylvania anthracite coal region by the Susquehanna River and deposited in the reservoirs behind the Safe Harbor and Holtwood Dams. Since 1934 the Pennsylvania Water & Power Co has annually reclaimed and burned about 200,000 tons of this coal. With the addition of the new Holtwood unit (No. 17), the annual requirements have been increased to 570,000 tons. This increase in use will not exhaust the supply because surveys indicate that silt presently on hand, together with a conservative estimate of the future inflow, would be sufficient to supply the fuel requirements of the plant for at least 35 years.

To recover this coal, a 14-in. hydraulic suction dredge, barges, unloader, wharf, and coal-reclaiming plant were constructed at Safe Harbor at a cost of $6.2 million. Fifty car loads of coal a day are delivered to Holtwood on a five-day week basis. Excess coal is placed on a 200,000-ton storage pile. It is used during the winter when dredging operations are suspended because of river freeze-over. Coal delivered to Holtwood averages 18% moisture, 16% ash, and has a heat rate of 10,000 Btu per lb.

**Site . . .** Consideration was given to locating the unit closer to the source of coal, but Holtwood proved to be the more economical site. Studies indicated that use of the existing Holtwood facilities would reduce operating and installation costs. In fact locating the new unit at Holtwood and using centralized controls have resulted in increasing the operating force by only four operators per shift.

The building substructure was designed as a flood wall and extends up to elevation 190 ft. The flood wall also serves as a foundation for the outdoor induced-draft fans. Station superstructure, including turbine room, boiler enclosure, and pulverizer bay, is steel with asbestos siding.

**Size . . .** Space limitations at the site, which precluded the use of more than one boiler, and the available anthracite coal supply determined the size of the unit.

The low incremental cost of river-bottom anthracite coal established turbine throttle conditions at 850 psig and 900F, and 4-point steam extraction.

**Boiler . . .** Capacity of the boiler is 700,000 lb per hour. If generation is limited by turbine capacity, it will be possible in the future to utilize the additional steaming capacity in the older units. Furnace volume is 96,000 cu ft, and the heat release is 9,600 Btu per cu ft per hour. Lighting off is done with oil torches and pre-dried mill coal.

At rated load the boiler burns 46 tons of coal per hour. The pulverized fuel is mill-dried by four horizontal ball mills each rated at 14 tons per hour with an entering coal moisture of 18%.

The boiler is the largest anthracite fired boiler in the world. It is of semi-outdoor construction, the rear wall and 40% of the front and side walls being completely outdoors. The furnace is a dry-bottom type, completely water cooled with 3-in. tangent tubes. Fuel enters the furnace through 16 vertical downshot twin-cyclone burners designed for pulverized fuel only. The burners are arranged in two opposed rows of eight burners each, one row along the front arch and the other along the reach arch. Firing is vertically downward, the flame trajectory forming a double "U". Refractory tile is provided on the front and rear walls and under the arches on the side walls for stable ignition.

Final boiler steam temperature is controlled by varying the moisture content of the steam entering the superheater. This is done in a surface type condenser through which a controlled portion of the boiler feedwater is passed as the cooling medium. No solids are added to the steam with this type of control.

**Fuel and Ash Handling . . .** Daily coal requirements of 2,500 tons are delivered to an 85-ton capacity track unloading hopper. Unloading is expedited by a "car shakeout." Coal is delivered from the hopper by a 360-ton-per-hr belt-conveying system to any one of eight 225-ton raw coal bunkers for the new unit, to the old plant bunkers, or to storage. Sandwiched between the two 4-bunker rows of raw coal bunkers is a single row of four 125-ton dry coal bunkers. Dry coal is supplied from existing facilities and is used only during startup or when extremely wet coal is delivered.

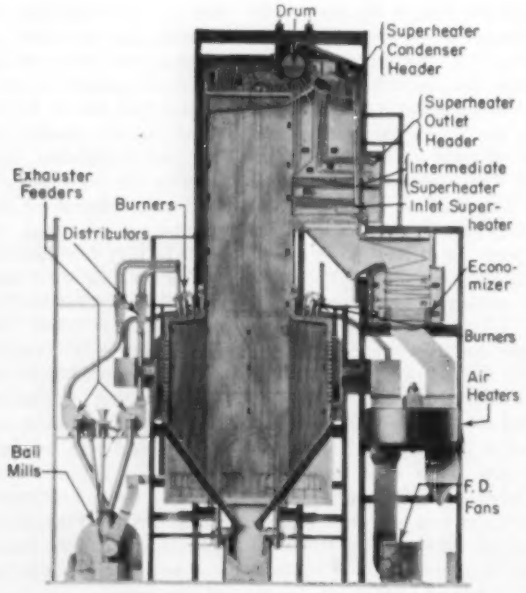
The company's past experience in handling the fine sizes of moist river-bottom coal was invaluable in designing coal-handling equipment, chutes, hoppers, and bunkers to avoid hang-up. Steep valley slopes with wide radius fillets were used in bunker design. Chutes and downspouts were made as nearly vertical as was practicable.

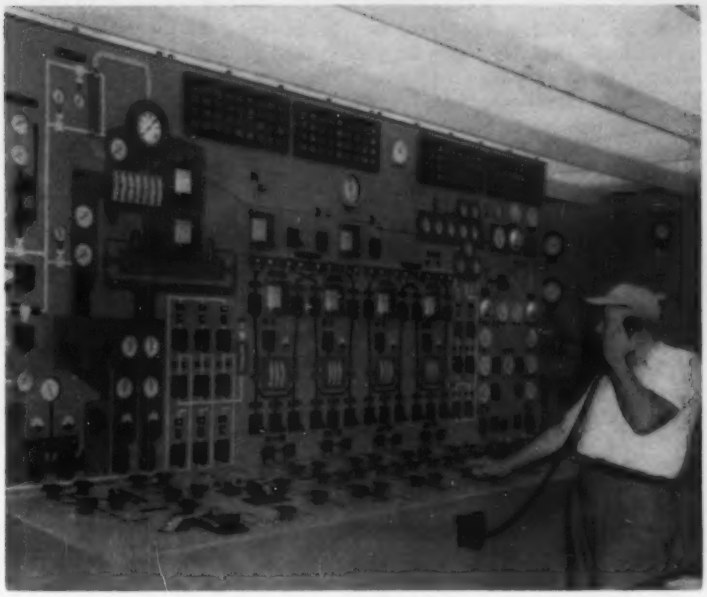
Furnace bottom ash is intermittently sliced from the furnace hopper trough into an open sluiceway. From there it is transported 400 ft by hydraulic jets to a settling and storage basin. After dewatering, the ash is claimed from the storage basin and disposed of by rail.

Fly ash from the electrostatic and mechanical fly ash collector hoppers is removed through a vacum transport line and hydraulic ejector. The fly ash slurry is discharged from the ejector into a sump. From here six centrifugal pumps, connected in series, pump the slurry at 250 psig through 4,000 ft of 6-in. steel pipe to a fly ash spoil basin, 450 ft above the river. The spoil basin is formed by an earthen dike. Settled fly ash will be bulldozed to increase its height to form additional storage capacity.

**Dust Collectors . . .** The dust collector consists of two sections of horizontal flow electrostatic precipitators followed by a single section multicyclone mechanical precipitator. The combination has a guaranteed overall collection efficiency of 95%. Because of the particles' high resistivity and their tendency to pack on the collecting electrodes, the electrostatic collectors are used on the incoming higher carbon dust. This arrangement, together with the continuous rapping feature of the electrostatic collecting electrodes, results in improved overall efficiency. As electrostatic separation of river-bottom anthracite fly ash has little, if any, selectivity as to size, the electrostatic section discharge is still a typical sample as regards size distribution; and the mechanical collector suffers no decrease in collection efficiency. Also, the mechanical collector can recover up to two-thrids of all puff discharge from the electrostatic unit during rapping operation.

**Cooling Water . . .** Originally it appeared that it would be necessary to extend the intake upstream to prevent recirculation when the hydroplant shut down. Tests showed that the circulating water discharge created a well-defined upper strata of warm water approximately 12 ft deep on the pond. However, the in-





**FUNCTIONAL ARRANGEMENT** of instruments at Holtwood power plant facilitates operation of the centralized control board. Colored mimics aid personnel to identify instruments

take was not extended as it was found that a floating boom with an adjustable submerged curtain wall constructed near the circulating water intake would hold back the warm water strata and permit the flow of cool water from below.

A corrugated metal pipe with a flap valve has been provided in the dam separating the inlet and discharge. During freezing weather, part of the warm discharge water is shortcircuited through this pipe to the inlet. This prevents icing of the trash screens.

**Central Control Room . . .** Arrangement of the central control room permits quick access to both the turbine and boiler floors. The central control board, soot-blower panel, fly ash handling panel, 110-v ac instrument panel, and 250-v dc distribution panel are located in this room.

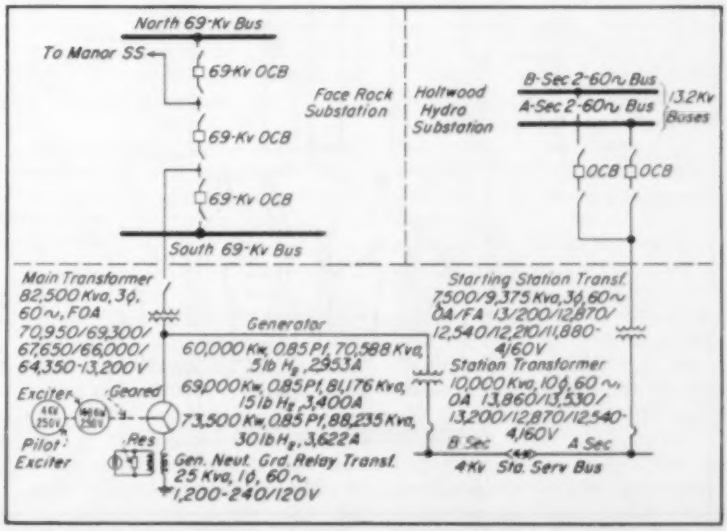
Instruments essential to the proper operation of the boiler, turbine, and their auxiliaries are located on the central control board. Automatic controls are extensively used to reduce operating labor costs. Manual-automatic control stations are provided on the control board for the important automatic controls. Steam, water, and oil pressure flow and level indications are transmitted by means of low-pressure air to the central control room. Miniature graphic recorders are mounted on the vertical section of the central control board.

The generator controls are in the hydro plant control room and, therefore, loading of the unit is performed by the hydro operators. The hydro operators also control the 13-kv supply to the station starting transformers. However, control of the station transformers and the station starting transformers' secondary switching as well as all generator auxiliaries is performed by the steam operators. Many of the annunciator alarms are common to both control rooms.

**Generator . . .** The generator is an AIEE preferred standard hydrogen-cooled generator. Exciter is directly connected through 3,600-1,778-rpm reduction gear. The generator is connected directly to the step-up transformer. From the generator terminals to the west wall of the station building the connection is made with a 4,000-amp, 15-kv metal-enclosed, isolated-phase bus. From the building wall to the transformer the generator leads are outdoor-type, field-assembled and protected by an aluminum enclosure. The generator is grounded through a distribution-type transformer with secondary loading resistor. Draw-out type potential transformers in metal-clad, isolated-phase type cubicles are located under the generator leads. Current transformers for metering and relaying are located on generator bushings and in wall bushings of the generator leads.

The bottles which supply hydrogen for generator cooling are located outdoors for safety.

**Excitation . . .** Normal generator excitation is 250-v dc. Exciter air supply is filtered and cleaned by an elec-




**ONE-LINE DIAGRAM** shows unit design. Generator is connected directly to main power transformer. A 7,500/9,375-kva station starting transformer is connected to hydro station bus

trostatic precipitator. Emergency excitation is provided by an existing motor-driven generator set located in the hydro station. Generator voltage regulation is accomplished by an indirect-acting, high-speed rheostatic-type voltage regulator. This regulator is located in the hydro station control room.

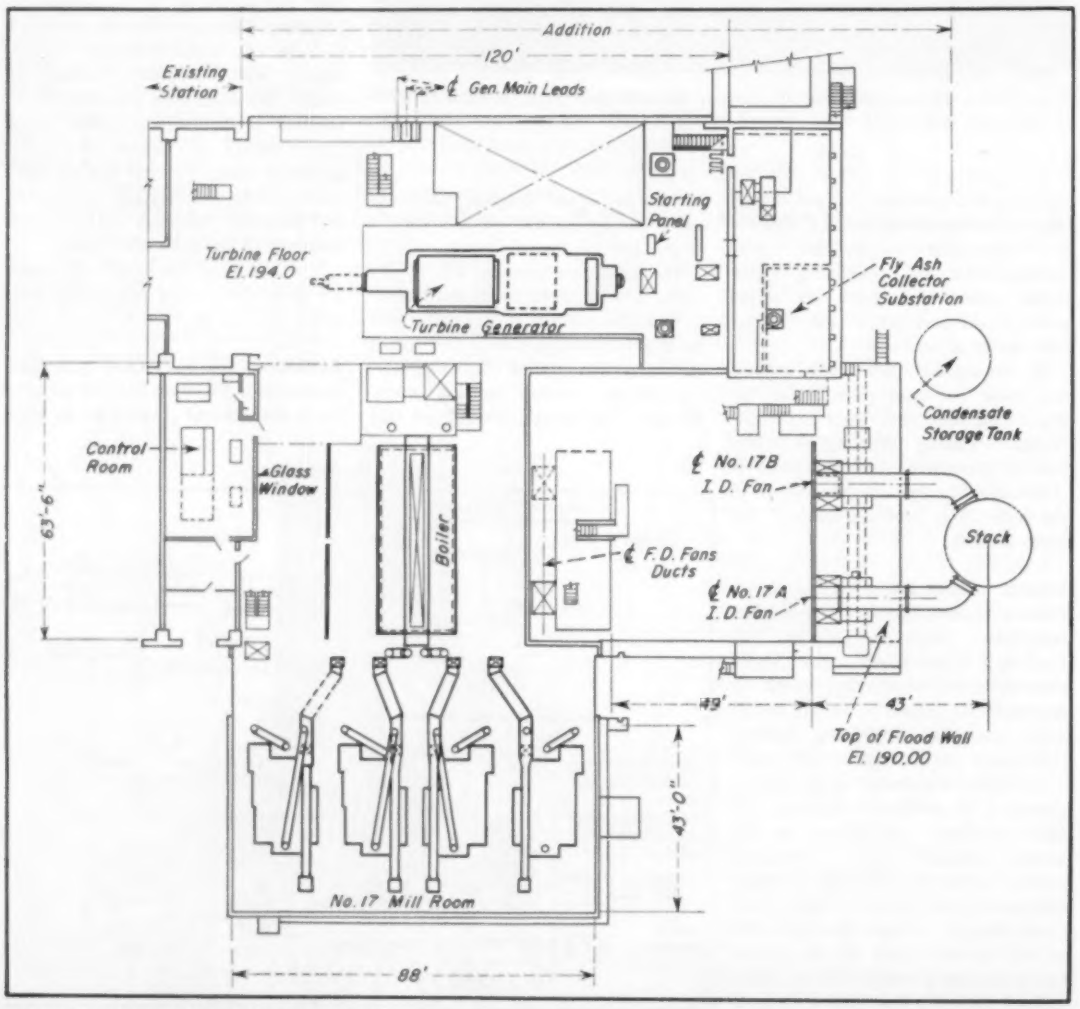
**Step-Up Transformer . . .** The step-up transformer is located approximately 250 ft from the generator terminals and connects the generator to the 69-kv substation located approximately ½ mile from the station. The neutral of the 66-kv winding is solidly grounded.

The transformer is forced-oil-cooled. Cooling is automatically controlled by winding hot-spot temperature detectors. Reliable station service to the oil cooling pumps is insured by two 480-v feeders provided with automatic transfer in case of feeder failure.

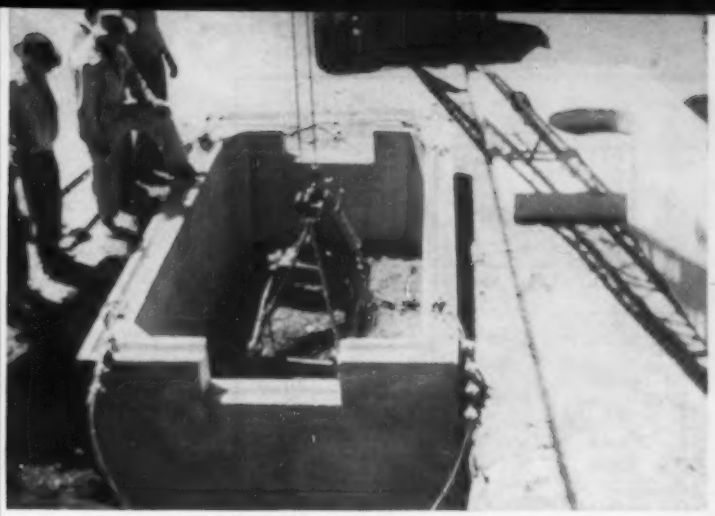
**Protection . . .** Relaying is in accordance with recent conventional design for a unit system. The transformer differential zone surrounds the generator differential, and a third overlapping zone protects the overhead 69-kv span between the transformer terminals and the remote 69-kv generator OCB's. A substation bus differential overlaps the generator OCB's. A generator neutral ground relay provides additional backup protection for the generator and the transformer low voltage winding. Similar backup for the 69-kv side of the transformer and the span to the substation is provided by a transformer neutral ground relay. A negative sequence current relay trips the unit to prevent rotor overheating. An offset mho-type relay for loss of field completes the protective scheme.

The generator OCB's trip circuit is routed through several thousand ft of No. 16 wire in a multi-conductor cable. To reduce this exposure, and at the same time guard against generator OCB failure, a second trip circuit initiated by the negative se-

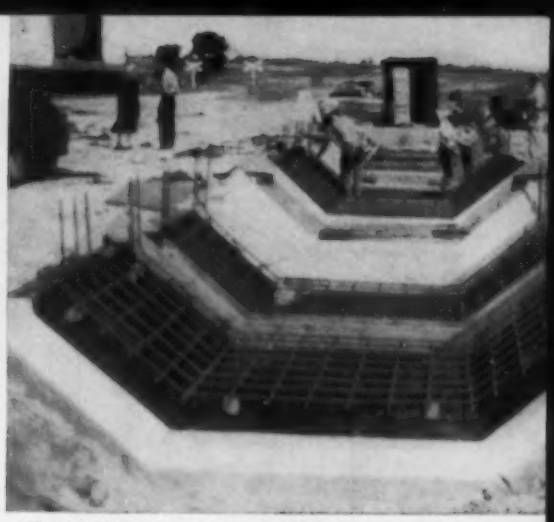
(*Continued on page* 146)




**GENERAL ARRANGEMENT DRAWING** shows indoor turbine generator and semi-outdoor boiler. Operators in control room at left have quick access to turbine and boiler floors. Station substructure serves as flood wall and as a foundation for outdoor induced draft fans



PRECAST MANHOLES are installed as caissons. The manhole is set in hole dug by clamshell bucket which keeps digging as the caisson keeps sinking



ASSEMBLY LINE production, developed by concrete products company, has been a big factor in reducing costs

## Northern States' construction experience shows . . .

# Precast Manholes Cut Costs 35%

**JOHN A. BERNER,** Underground Engineer, Northern States Power Co, Minneapolis, Minn.

Precast concrete manholes today save time and money for the Northern States Power Co on construction work on the Minneapolis underground system. Besides costing less per installation, this method of manhole construction cuts the time that city streets remain open for the setting of concrete.

During 1953 and 1954 Northern States installed about 100 precast manholes, most of them without concrete floors. Where the water table was above the manhole floor elevation, concrete slabs were poured in place, where they usually served as the only footings. Some footings, however, were required where the ground was not firm.

Where one or two manholes were installed on a single job, savings were found to approximate 10 to 15%, compared with the costs of the conventional method of building manholes in place. Savings were as much as 30 to 35% where five or more manholes were installed on one location as parts of the same job.

A big factor in the economics of precast manholes on the Minneapolis system is the employment of a private concrete products firm which developed a process for casting that approaches assembly-line production methods. Repeated use of the casting forms reduces this cost per manhole to an almost negligible figure.

**Manhole Sizes . . .** Four sizes of manholes have been precast, the inside measurements of which are as follows:

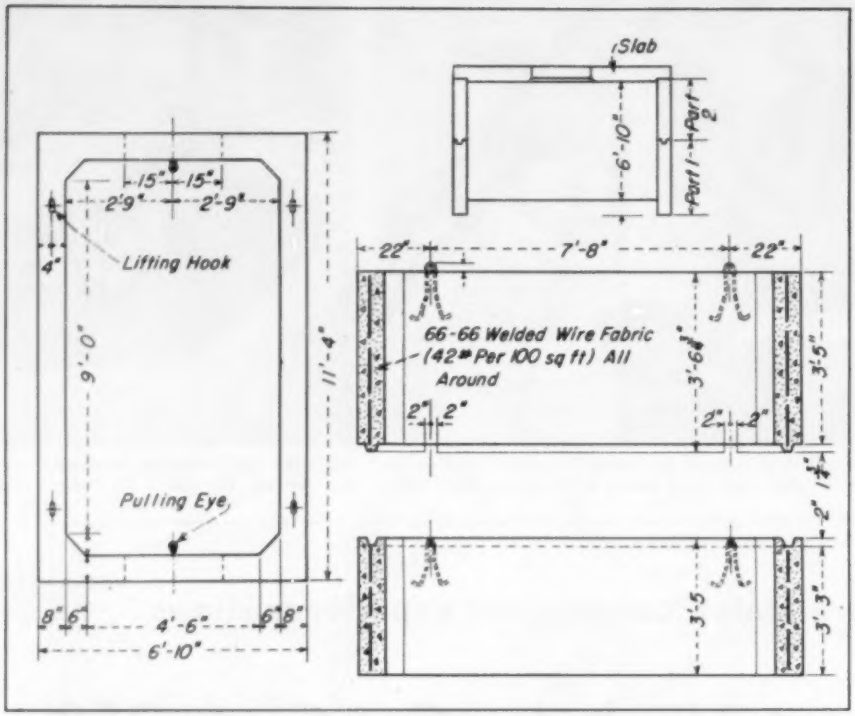
1. 5½ ft by 10 ft rectangular.
2. 7½ ft by 10 ft three-way.
3. 6 ft by 11 ft two-way.
4. 8 ft by 11 ft three-way.

All manholes are cast with openings for the later installation of conduits. The reinforcing rods are continued through these openings. When a manhole is being installed as a caisson, boards placed behind the rods keep dirt from running into the manhole. The rods strengthen the ends of the manhole and are so spaced that they do not have to be removed when the conduit is installed.

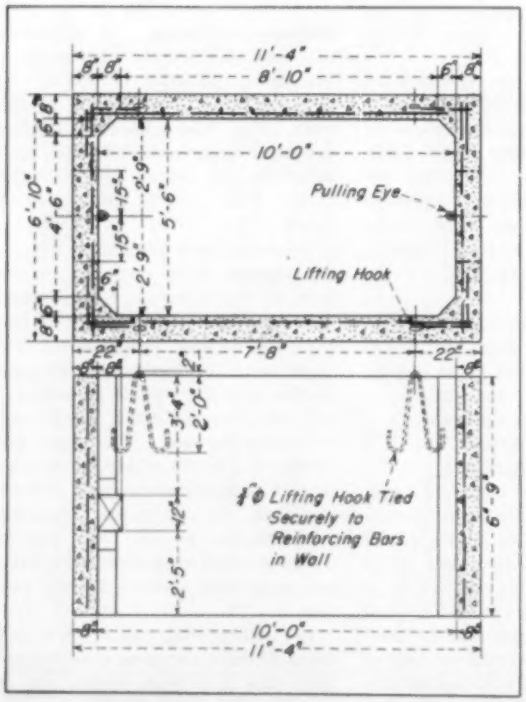
**Methods of Casting . . .** Manholes have been cast as three separate units: The cover, the upper portion of the walls, and the lower portion of the walls. They have also been cast as two separate units, the manhole roof being one unit and the four walls the other. This casting employs steel forms.

Manholes have also been cast as five separate units, consisting of the roof, the two sides, and the two ends. The sides are tied together by the ends, and all four walls installed as a single unit. This method permits casting the sides and walls in a horizontal position, thus facilitating the placing of reinforcing steel. The forms are similar to a trench which can accommodate as many as ten wall sections at a time. On one project, requiring 53 manholes, ten sides were cast at a time so that five manholes with walls and roofs were completed every two days.

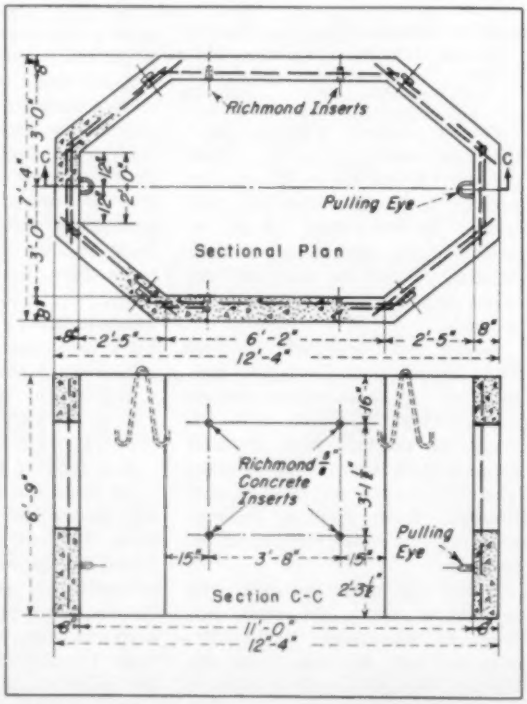
In installing walls cast in upper and lower sections, dirt came between sections that had been jostled out of position. This difficulty was overcome by tying two sections together with a




THREE-UNIT DESIGN for manhole casting provides for upper and lower wall sections and the roof. This design keeps down the weight of each section so that it can be handled with a 10-ton crane during installation




TWO-UNIT DESIGN for manhole consists of walls cast as one unit and roof as another. Wall sections cannot be displaced in installation




FIVE-UNIT DESIGN provides for casting each side and end as a unit and the roof as a fifth unit. Ends are used to tie sides together

CASTING SIDES in a concrete form in a trench has speeded up the work so that five complete manholes are completed per day

CRANE, 10-ton type, places precast manhole walls in excavated hole after indications of "cave-in" have been observed by working crew

ROOF SLAB is placed in position by crane. Following its placement a mortar seal is made between the manhole walls and the roof slab

temporary iron clamp. This method of casting was used to keep the weight of each unit within limits easy to handle. Each unit, weighing not more than six tons, could be handled with a 10-ton crane.

**Installation Methods . . .** Manholes cast in the yard of the concrete products company are hauled to the site on a low-bodied truck trailer. Pavement openings are made, and a crane and clamshell bucket excavate until the walls show evidence of "cave-in." The crane then places the precast manhole walls in the excavation, and the digging is continued with the clamshell inside the manhole walls. At intervals men enter the manhole to remove earth under the walls, causing the walls to sink as a caisson. Installing four walls to the required depth takes only one to two hours.

Next, a crane places the manhole roof slab in position, and a mortar seal is made between the walls and roof slab. The iron manhole casting and cover are placed in position and rested on two to four courses of bricks to bring it to the street grade.

**Relative Costs . . .** The time for installing a precast manhole depends on the number of manholes being installed on a project. One manhole on an isolated project can usually be installed in eight hours. On a larger project, such as the 53-manhole project in south Minneapolis, two precast manholes were easily installed in an eight-hour working day, excluding the time for installing the manhole casting and completing the street paving.

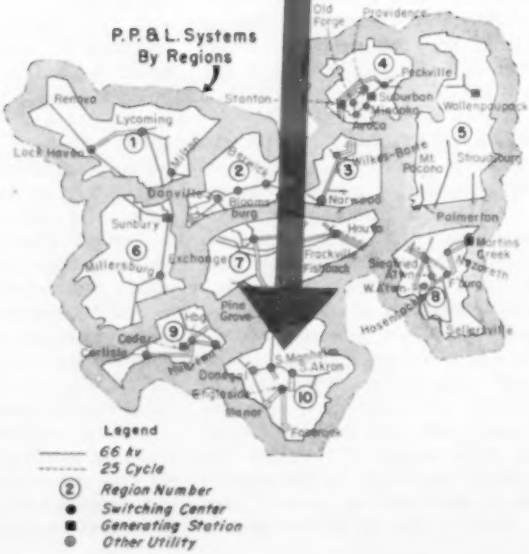
Building manholes by using wood forms and sheeting took approximately six days compared with the four to eight hours for the precast manholes. Construction in place by using standard sectional inner forms, sheeting for outer forms, and power excavating equipment required approximately a day. Furthermore, the poured concrete must cure for several days before the forms and sheeting can be removed. The installation is then completed by placing the iron casting and cover and finishing the street paving.

The new method effects considerable savings by the elimination of sheeting and form work. In the wood-form method, using power equipment for excavation, approximately 60% of the labor goes into the form work. On the other hand, the new method incurs other expenses, such as transportation and crane service.

Northern States Power Co engineers believe that their methods are applicable in most sections of the country. This is especially true where a utility has decided on a large-scale installation of manholes.

# System Planning Is Based on 100

**Supply facilities are added in PP&L 'island' units in step-by-step expansion program for integrated transmission, distribution system to meet loads that increase continually**



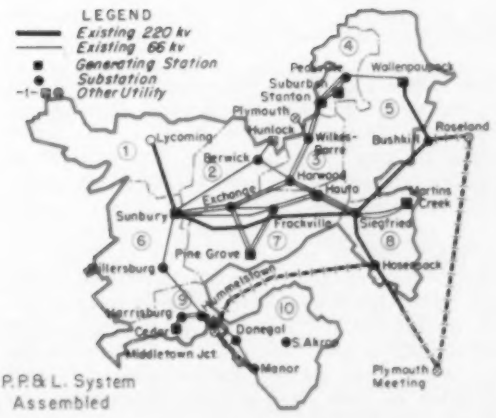
**NICOLAS N. SMELOFF,** Electrical Power Systems Consultant*

# Service Areas

Pennsylvania Power & Light Co's plan to meet today's continually mounting load is based on 100 component, essentially self-contained, service areas. Supply facilities are planned for each of these areas to meet arbitrarily selected double and treble loads. Annual load checks and reviews of local industrial, commercial, rural, and residential developments make it possible to anticipate requirements for additional facilities on an annual or longer-term basis.

Each service area has its step-down substation and distribution circuits and is linked to neighboring areas by subtransmission. Transmission circuits tie up the subtransmission regions into the PP&L system. Such functional division of its territory enables PP&L to review the principles and patterns evolved for general system development, emphasizing the "bread-and-butter" system parts through which load is largely supplied.

This approach, focusing on kw growth, reactive requirements, and voltage conditions as continual checks on the adequacy of facilities, permits comparatively simple planning. Coordination of area, regional, and system facilities in overall design affords minimum costs of supply facilities.




**Areas and Regions . . .** The essential independence of areas can be seen on p82. When local facilities fail to meet growing load, a new area is carved out of parts of adjacent areas. This is done by providing a new 66-12-kv supply substation and resectionalizing the 12-kv lines to serve the new area.

Adjacent areas with common supply facilities and comparable terrain, loads, and type of industrial or agricultural composition comprise regions, such as Lancaster region (p82). There are ten such, each composed of six to seventeen areas. The regions are self-contained also, having regional supply facilities, 66-kv transmission lines, and substations.

Finally, the collective supply regions make up the coordinated company system. Below is shown the ten regions and the 220 and 66-kv system lines which connect all supply regions, tie in generating stations, and provide system interconnections.

Studies, projected five, ten, and twenty-five years into the future, indicate that system connections which now include some 66-kv circuits will gradually evolve into a network of 220-kv lines only. Each region will have one or more supply stations stepping down from a 220-kv network to groups of the 66-kv lines. Regions will normally operate as "islands" and will not be interconnected at the lower voltage.

**Integration . . .** In this way, a thoroughly coordinated system will develop. Generation, transmission, and distribution will be related and grouped functionally to allow the planner to retain the concept of area facilities being built into regional facilities, and regional into system facilities. Such grouping is applicable also to the preparation of annual budgets and the scheduling and control of construction work.

Thus, the expansion of power facilities is carried out as a continuing process, and maximum flexibility is afforded for ready adjustment to changing conditions and technological developments in power production, delivery, and utilization.

**Area Development . . .** Expansion of area supply facilities occurs through additional transformer capacity at supply substations and, where warranted by load conditions along new routes, additional feeders. Sometimes an area is split to create a new area with a new supply point and to reduce not only the load on feeders but their length as well. This process can be continued indefinitely. Tests of this method of expansion have proved it satisfactory for many times existing load.

With very few exceptions area supplies are operated at the company's standard 12 kv. This voltage is used throughout rural areas where it traverses the potential locations of loads along the roads and valleys. It is also used in industrial centers and built-up communities where it overlays the principal areas of larger loads. Generally, 12-kv circuits are operated radially to obtain the greatest simplicity in relaying and speed in clearing and restoring faulted lines.

**Load Responsibility . . .** In the general pattern, each area substation has two transformers selected in accordance

*Formerly System Planning Engineer, Pennsylvania Power & Light Co, Allentown, Pa.

with load forecasts for the next three years on the basis of thermal capability. The term "load responsibility" has been established to apply to substations in adjacent areas connected to each other's 12-kv distribution. An area substation not connected to adjacent areas has thermal capability adequate for its normal load responsibility.

Maximum emergency load responsibility pertains to an area substation called upon to carry part of an adjacent area load in emergency. When part of an area's load has been transferred to another during emergency, the remaining load is the minimum load responsibility of that area substation. This load is carried by utilizing the remaining transformer's emergency thermal capability.

**Area Voltage Control . . .** Voltage control is provided on an area basis. It is obtained principally through judicial use of synchronous condensers and switched capacitors to produce minimum voltage drops at time of peak loads. Requiring reactive to come from more distant generating stations produces the needed reduction in voltage during off-peak periods. Since low-cost switching facilities have become available, capacitor installations are being made on individual feeders, with minimum economically justified 3-phase installations of possibly 450 kva at 12 kv. These capacitors are switched by voltage. This method dispenses with regulators on feeders and buses or tap changers under load at area substations.

The amount of load a substation carries, as determined by area load density, can vary from 500 to more than 30,000 kw. Several standard types of substations have been developed to suit different load requirements.

**Regional Facilities . . .** Regional facilities consist of 66-kv lines and sources of supply provided by 220-66-kv step-down substations or 66-kv buses of some generating stations. Except for the 220-kv system, 66-kv circuits are the only ones operating in a network. Some of these circuits now connect various regions and generating stations.

Load growth could reach proportions where it would be undesirable to operate the system 220-kv and the regional 66-kv networks in parallel. At such time, according to long-range studies, the 66-kv network could be broken up into strictly regional islands. New 66-kv would be confined to regional lines for future supply to area loads or to individual large customers.

More than one 66-kv circuit is seldom built now along a single route. An exception may be dictated by high cost of right-of-way. Where PP&L considers double-circuit steel tower construction economic, only a single circuit may be installed initially.

In general, regional facilities are distributed as much as possible over the entire terrain, and the lines are usually operated in a network. Radial operation, where required, has supplied loads with a high degree of service continuity.

**Regional Substations . . .** Usually regional substations have sectionalized buses, each with independent step-down transformers from 220-kv lines or buses. Regional lines are selected for connection to buses so that total power loss will not be experienced in the region when one bus section is lost. A regional substation may be a switching center where provision has been made for future supply from 220-kv system lines.

The adequacy of regional supply facilities can be checked independently. Regional load estimates are prepared, and total reactive requirements are kept under surveillance with a view to supplying them locally. Supply importations from other regions or from the system can be closely watched.

Regional 66-kv voltage is kept within limits usable for direct service to consumers of power. This voltage is regulated according to a load curve by tap changers under load at the 220-66-kv substations, by generating stations, and by switched capacitors in the supply areas. The dividing line between reactive supplies furnished by areas and those provided by generating stations probably is at regional level. No use has yet been found for capacitor installations on voltages higher than 12 kv, nor are such applications foreseeable on the system.

**System . . .** Major transmission, generation, and interconnections constitute system facilities. The system transmission network, eventually to be 220 kv exclusively but now including some 66 kv, has three major purposes:

**1.** It interconnects generating stations for efficient system operation and to obtain flexibility in the use of reserve generating capacity and in the selection of generating sites.

**2.** It establishes interconnections.

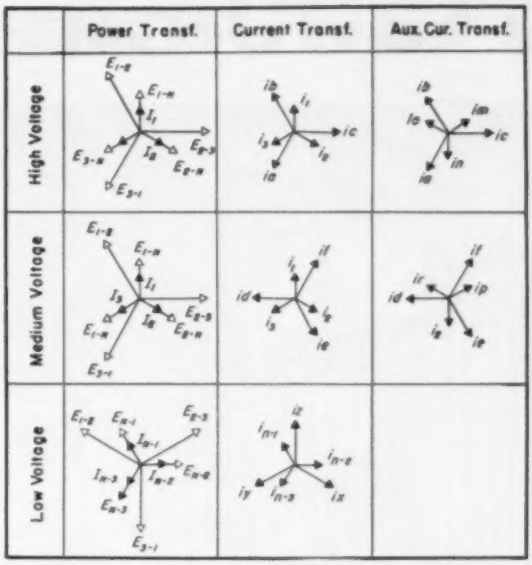
**3.** It provides 220-kv channels for supply to large load centers.

The planning of system transmission facilities follows the pattern of providing single lines over selected routes. Consideration is given to possible future loads to be served by augmenting bulk power supply to the regions and to the accessibility of future generating stations. In the country's earlier days the Susquehanna River afforded favored locations for founding communities and commercial and industrial establishments. These riverside locations today indicate the logical route of a large-capacity 220-kv transmission line which not only transmits power from point to point but may be tapped wherever bulk power is required.

The 220-kv system transmission was planned to operate in a closed network. Lines are lightning protected, designed to withstand the usual local sleet storms, and adequately protected from right-of-way hazards.

**System Voltage . . .** Functional requirements determine the 220-kv system operating voltage levels. Voltages may attain values suitable for power transfers from region to region and from system to system. This variability in voltage level necessitates tying in the 66- and 220-kv circuits through under-load tap changer on the 220-66-kv transformers, sometimes called a "flexible" coupling.

As power systems grow, the relative capabilities of 220-kv circuits will shrink materially in relation to total system load. When this relationship is given proper cognizance, the function of 220-kv lines and networks can be made to conform with their original purposes. On the PP&L system there are no localities where fuel costs vary widely or when large hydroelectric capacities are available at points distant from utilization. Consequently, there appears to be no need for voltages higher than 220 kv.



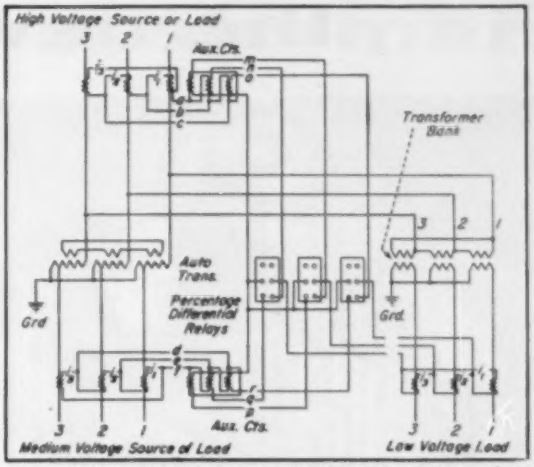




FIG 1—AUXILIARY CURRENT TRANSFORMERS eliminate three high-voltage current transformers in this substation protection scheme

FIG 2—VECTOR RELATIONS for the accompanying circuit diagram are shown under conditions where the load has unity power factor

# Substation Differential Protection Scheme Saves $8,596

R. L. de LOACHE, Cleveland Electric Co, Atlanta, Ga.

A transformer differential protection scheme developed for the power circuit shown saves substation space, labor, and $8,596 in current transformers. The savings result from using six auxiliary current transformers costing less than $400 instead of three high-voltage current transformers costing about $9,396 in the 110-kv class.

In applying differential protection to a delta-star connected power transformer bank, it has been customary to connect current transformers in star on the delta side of the bank and in delta on the star side. When the power transformer bank is connected star-star, the practice has been to connect current transformer in delta on both sides of the power bank. These connections provide the proper phase relations for balanced three-phase conditions and for all types of through faults.

In Fig 1, one power transformer bank is connected star-star and the other is connected delta-star. The banks are paralleled on the high-voltage side. If the usual practice is followed, four sets of line current transformers would be required for differential protection because the phase relations across the two banks of transformers are not the same.

However, one set of high-voltage current transformers can be eliminated by connecting two banks of delta-star auxiliary current transformers as shown. The auxiliary current transformers provide proper phase relations to satisfy all conditions. A complete vector analysis is shown in Fig 2.

Secondaries of all line current transformers are connected in delta, including those on the star side of the delta-star power bank. This overcomes the objection to star-connected current transformers on the star side of a star-delta bank with grounded neutral by providing a path for zero-sequence secondary current to circulate through the current transformer secondaries instead of through the relays.

# Lifting Rig Raises Generator by Its "Boot Straps"

H. O. HODSON, Vice President, Southwestern Public Service Co, Amarillo, Texas

Generators are being raised into place safely and in less time with a "boot-strap" lifting rig built by Southwestern Public Service Co, Amarillo. The portable rig has replaced timber crib structures in the installation of generators at several plants on the system. It also can be used to unload generators or large power transformers from flat cars at rail sidings. In one instance, a 50,000-kw machine weighing 213,600 lb was lifted 30 ft. The lift took only 18 hr and required but five men.

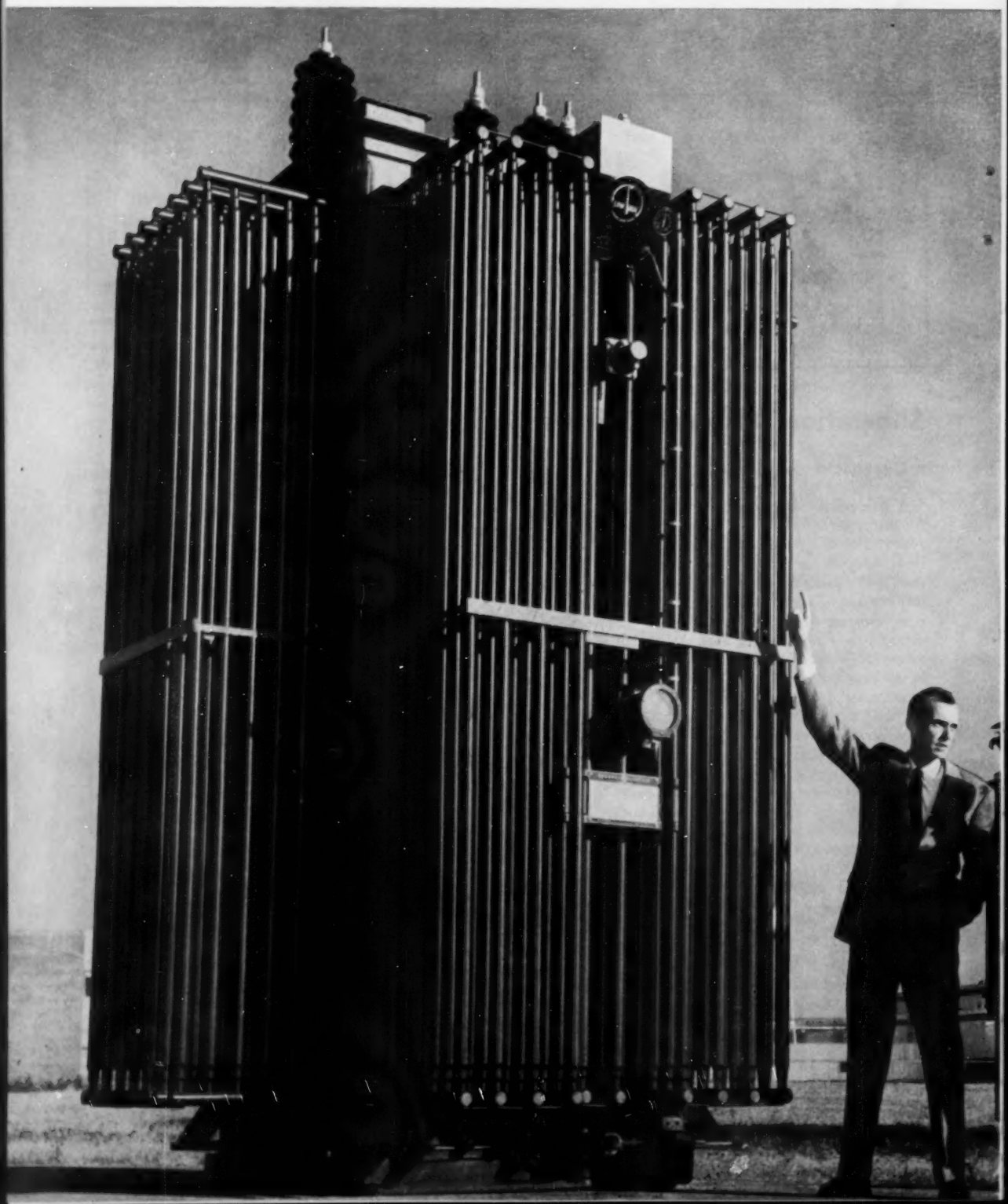
The lifting rig consists of four H-beam columns, a platform, and two bottom I-beams. The legs are 40 ft long, 12-in. WF 65-lb columns with 1⅛-in. holes spaced 4 in. apart in the flanges. For each lift, the legs are set on concrete pads adjacent to the turbine platform. Legs are braced horizontally at top and bottom by 12-in. WF 65-lb steel H-beams and diagonally on all four sides with 3x2½-in. steel angles.

Lifting platform consists of five 30-in. WF 108-lb

(Continued on page 91)

ANNOUNCING

# the new 1955 G-E



# RM power transformer

## A COMPLETELY RE-DESIGNED TRANSFORMER... WITH INSTRUMENTS GROUPED IN ONE EASY-TO-READ CONTROL CENTER . . . PLUS MANY OTHER NEW FEATURES YOU'VE ASKED FOR

Now a complete re-design of General Electric's entire RM (Repetitive Manufacture) line of power transformers brings you many new features that mean easier installation, less maintenance and longer life.

In the new 1955 line of RM transformers, for example, all instruments are grouped in one convenient location. Called the "control center," this unique arrangement improves visibility and simplifies maintenance. Recessed behind the cooling tubes, all accessories including the tap changer operating handle are protected against accidental damage. All are safely accessible even with the transformer energized.

**Many new money-saving features** of G.E.'s 1955 RM transformer line resulted from product planning meetings with more than 75 electric utilities. Such things as American Standard bushings, weather-tight conduit, extra jacking space, and pre-fitted arrester-to-bushing connectors were first suggested by the men who actually use and install transformers.

The 1955 line has also been re-designed to give you a transformer of even greater reliability. Use of Formex* wire, for example, results in a smaller, lighter, yet more dependable unit. All single-phase transformers feature improved performance because of Spirakore* construction which gives you the full benefit of the directional properties of grain-oriented steel.

**Your acceptance of power transformer standardization** has made this new transformer possible. Available in ratings 501 to 5000 kva single phase and 501 to 10,000 kva three phase, 69 kv and below, 1955 RM transformers are being built at Rome, Georgia, on the nation's only real "mass production" line for power transformers. To see how these new transformers can benefit you, just get in touch with your nearest G-E Apparatus Sales Office or write for Bulletin GED-2505. Address your request to Section 416-1, General Electric Company, Schenectady 5, New York.

*Reg. trademark of General Electric Company

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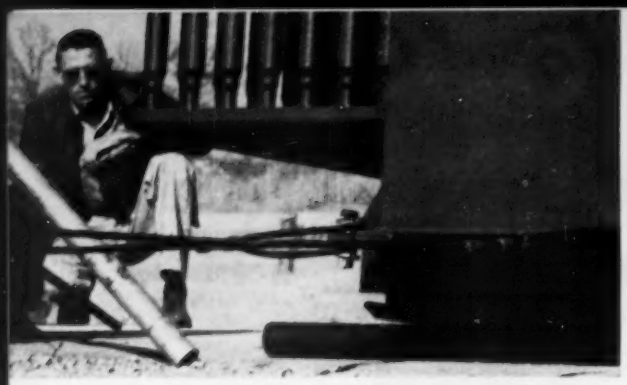
## To See More of the Advantages of G.E.'s New RM Transformer for '55

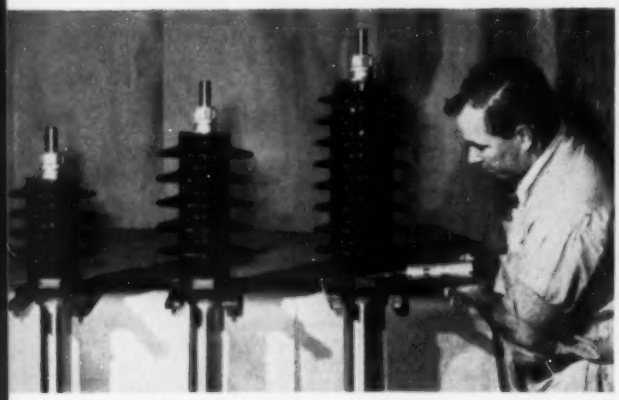
TURN PAGE→



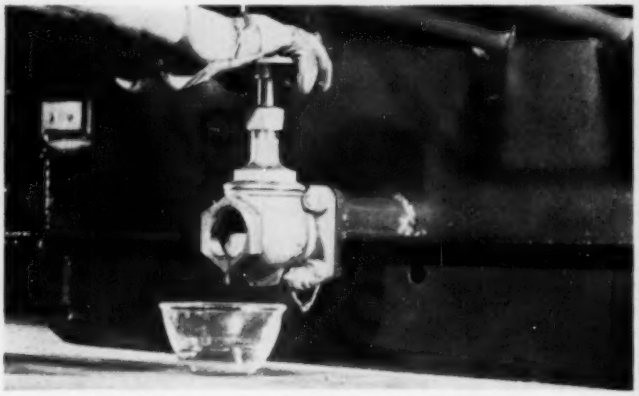
**SKI-TIP BASE** on '55 model mounts rollers smoothly for faster, easier installation.

**EXTRA JACKING SPACE** saves time, permits use of most jacks available in the field.

# G.E.'s new 1955 RM trans-



**AMERICAN STANDARD BUSHINGS** on all '55 units will eventually help reduce your bushing inventories.



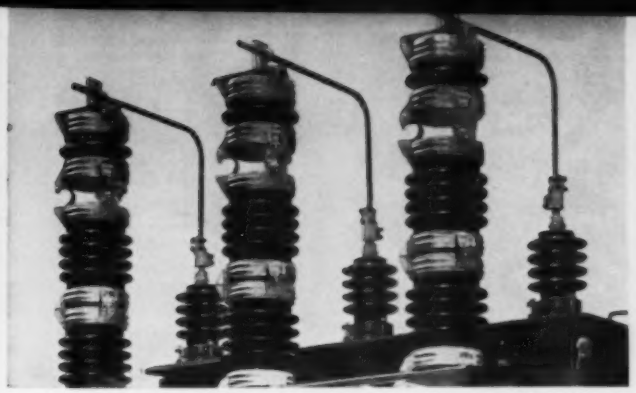
**FULL DRAIN** allows you to filter **all** the oil. Result: more effective filtrations, more accurate sampling.

# has many features that

**DOMED COVER** sheds water to help prevent rusting on top of the transformer.

**WEATHER-TIGHT CONDUIT** and fittings keep out water, yet are quickly assembled without cutting threads.

# and give longer service life



**PRE-FITTED CONNECTORS** between arresters and bushings save time and expense of fabricating in the field.

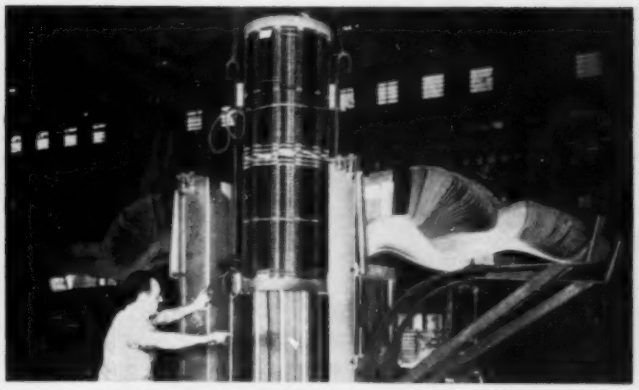
**FORMEX* WIRE** (right) more rugged than paper and tape also reduces transformer size and weight.

# former is easy to install

**RE-USABLE NITRILE GASKETS,** applied throughout 1955 line, require no cement, are easily used over and over again.

**SUPER MELAGLYP FINISH**—flow-painted on—gives the 1955 G-E transformer superior rust protection.

# reduce maintenance costs



**SPIRAKORE* DESIGN** gives improved performance to all single-phase transformers in the 1955 line.

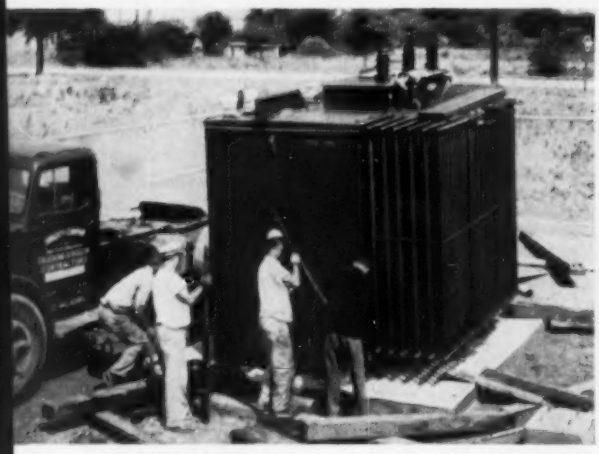
*Reg. trademark of General Electric Company

**ADJUSTABLE COIL CLAMPS** tighten windings after drying, keep coil stack rigid to resist mechanical stresses.

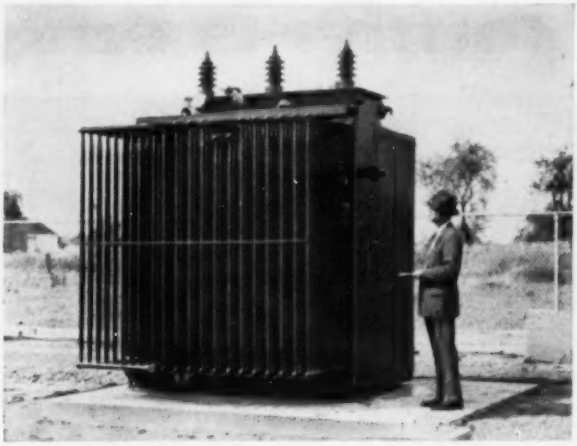
GENERAL ELECTRIC

**1. JACKING UP** substation to move from trailer was the first installation step. Unit had already been trucked 18 miles when this operation started at 11:20 a.m.

**2. QUARTER TURN** gets unit in proper position for jacking down to foundation. Winch on truck makes turning substation a simple operation—speeds installation.



**3. JACKING DOWN**—the final step—was started early in the afternoon and completed by 3:20 p.m.



**4. IN FINAL POSITION,** ready for assembly of lightning arresters and erection of station steel.

# Positions G-E unit substation in 4 hours

## PUBLIC SERVICE ELECTRIC AND GAS COMPANY OF NEW JERSEY CUTS INSTALLATION MAN-HOUR COSTS WITH PRE-ASSEMBLED G-E SINGLE-CIRCUIT SUBSTATION

Pre-assembly at the General Electric factory allowed the Public Service Electric and Gas Company of Newark, New Jersey, to unload this G-E unit substation at the freight yard, transport and position it on its foundation, ready for connection, in a single day. Starting at 7:30 a.m., the unit was trucked 18 miles to the site and skidded onto its foundation by 3:20 in the afternoon. The installation operations of unloading, skidding and jacking down required only four hours.

**HERE'S HOW YOU, TOO, CAN BENEFIT BY SPECIFYING G-E SINGLE-CIRCUIT UNIT SUBSTATIONS:**

**Easier installation:** No field assembly is necessary. All components are co-ordinated and assembled at the factory. This drastically cuts installation time.

**Low, predictable installed cost:** You don't have any accessories or "extras" to buy with G-E packaged substations. Since installation consists merely of locating the unit on its foundation and connecting the leads, installation expense, which can be readily estimated in advance, is reduced to a minimum.

**Simpler purchasing:** There's only one specification—one transaction when you buy G-E single-circuit substations. And you get centralized responsibility, too, because all unit components are engineered and manufactured by General Electric.

For full details, contact your nearest G-E sales representative or write General Electric Company, Section 422-20, Schenectady 5, New York.

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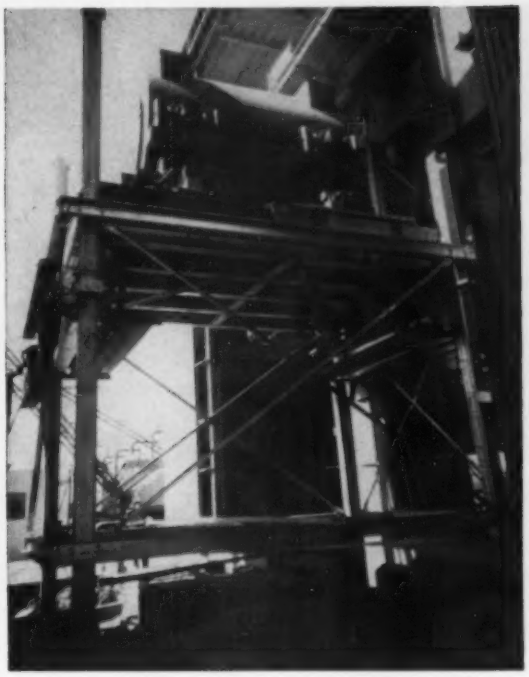
GENERAL ELECTRIC

## Lifting Rig

(*Continued from page 85*)



I-beams braced in the middle to form an area measuring 18x25 ft. A floor is provided by 24 timbers each 1-ft square. Planks over this floor provide a level surface on which the generator cribbing structure rides.

Under the platform are the two bottom 24-in. box beams. Lifting power is provided by four 50-ton air-operated screw jacks, one at each end of each bottom beam. The jacks attach to both the beams and the platform. The entire structure bolts together for ease in assembly and disassembly.

In operation the platform literally climbs the column. Bottom beams and platform are bolted onto the columns so that the platform is at the proper height to receive the generator. Jacks are placed in minimum-height position after generator is in place on platforms. Platform-column attachment bolts are removed and the jacks are operated to lift the platform 12 in., after which the platform is bolted to the columns and the bottom beams unbolted.

The jacks are reversed, bottom beams and jack bases are hoisted upward 12 in. The bottom beams are again bolted in place, the jacks pick up the load, top platform column bolts are removed, and another lift can then be started.

In the initial design of the lifting rig as illustrated, workmen stood on planking supported by steel channels to install and remove the bolts. However, for greater safety, traveling scaffolding will be attached to the end of the bottom beam for the workmen to stand upon. This hoisting device is designed for and will be used for hoisting generator stators up to and including 100 Mw rating, and weighing up to 190 tons.

# Trucking Fuel Oil to Plant Provides Substantial Savings

**C. C. ROUSSEAU,**
Production Superintendent, Florida Power Corp, St. Petersburg, Fla.

Trucking fuel oil 115 miles from Inglis power plant to Suwannee River power plant by a company-owned fleet provides substantial savings for Florida Power Corp over other forms of public transportation. Moreover, a dependable and controlled flow of oil is assured to the new station.

Decision to truck oil was reached after other methods of transportation were studied. Suwannee River is not navigable but does provide sufficent water for condensing. Nearest terminal from which ocean-going tanker shipments could be transported to the plant is at Jacksonville. But highway congestion and terminal facilities presented a great number of difficulties.

(*Continued on page 94*)

**UNLOADING OIL at Suwannee is done by pumping. Steam is provided for heating oil**

**TRUCK LOADING DOCK at Inglis power plant is capable of pumping oil into four tank trailers simultaneously. It is 80 ft long, 19 ft high, 21 ft wide, and has storeroom for grease**

# ALL NEW G-E CAPACITOR

## Field-tested assembly over *50* percent stronger handles one or two copper or aluminum lines; exerts 1000 lbs. contact pressure through corrosion resistant connector.

Every General Electric outdoor capacitor with glass bushings now has a stronger terminal that's far easier to handle.

Here are the details that give this sturdy new terminal its practical advantages:

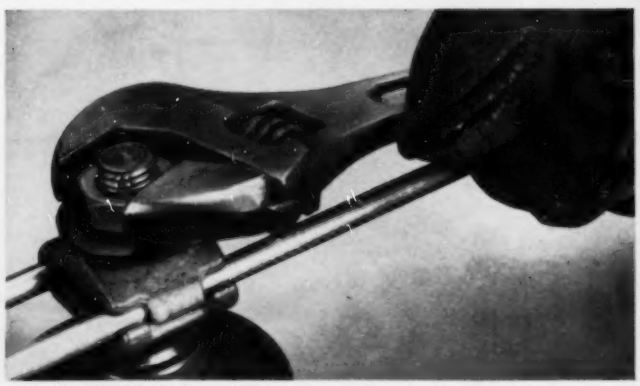
**1.** Conductors can be quickly inserted in the assembly without threading. **2.** One or two copper or aluminum conductors from No. 10 AWG solid to No. 2 AWG stranded can be clamped securely. **3.** Two Belleville washers exert a constant pressure of over 1000 pounds, forcing the parallel-groove connectors to follow the cold flow of aluminum. **4.** The hex nut will strip without damaging the terminal stud if excessive tightening torque is applied. It can easily be replaced with a new nut. **5.** Accidental loss of this nut is reduced because the top threads on the terminal stud are staked. Yet, if necessary, the nut can be forcefully removed. **6.** The parallel-groove connector is tin-plated to provide good conductivity and minimize corrosion.

Every element of this design has produced a strong and dependable terminal assembly requiring a minimum of time and effort to connect. Ask your G-E Apparatus Sales Engineer for more information. General Electric Company, Schenectady 5, New York. 441-23

*Progress Is Our Most Important Product*

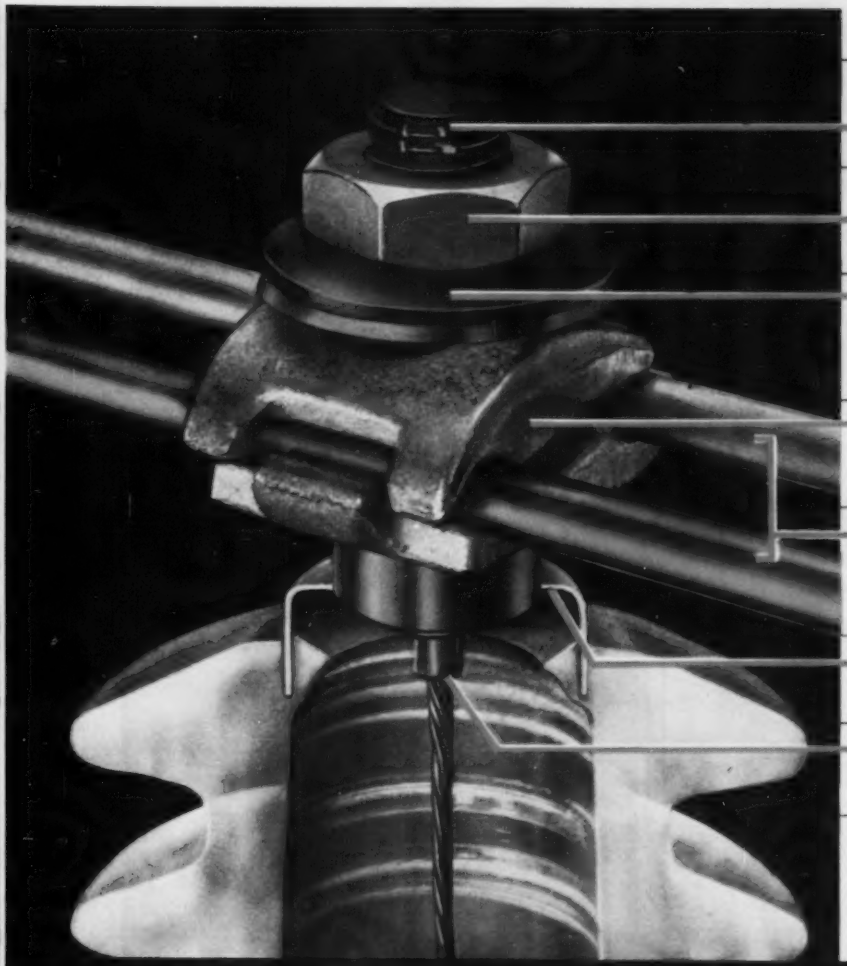
# GENERAL ELECTRIC

**NO THREADING** of conductors is needed with parallel-groove connector. Loosen nut and conductors slip in place.



**BELLEVILLE WASHERS** maintain over 1000 pounds contact pressure on connector. Flat washers indicate proper torque.

# TERMINAL *at no price increase!*



**STAKED THREADS**
keep assembly from being accidentally removed

**NUT STRIPS FIRST**
if excess torque is applied, avoiding damage to stud

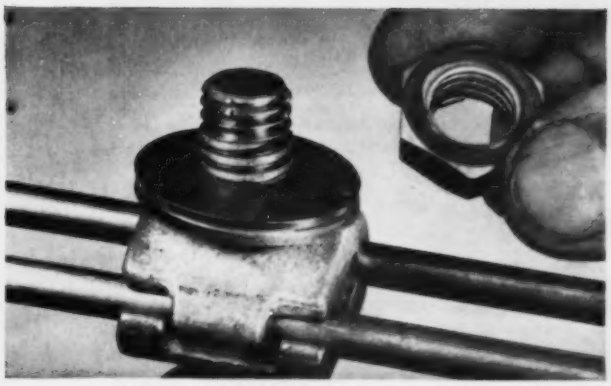
**POSITIVE CLAMPING**
with Belleville washers follows cold flow if aluminum conductors are used

**TIN-PLATED CONNECTOR**
provides good conductivity and minimizes corrosion

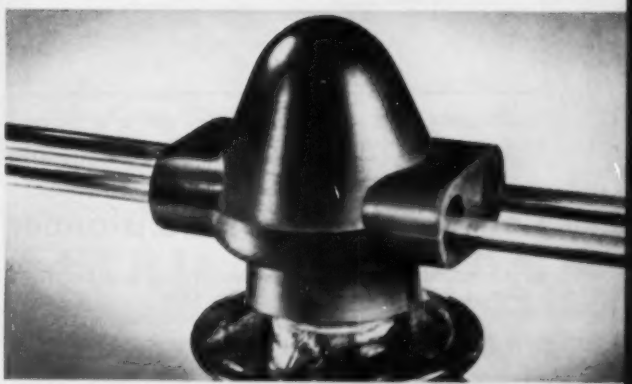
**HOLDS 1 OR 2 AL OR CU CONDUCTORS**
from No. 10 AWG solid to No. 2 AWG stranded

**PRESSURE-BRAZED TO CAST-IN-GLASS FLANGE**

**CRIMPED AND BRAZED LEAD-WIRE CONNECTION**



**NUT STRIPS BEFORE THE STUD,** preventing damage to stud threads due to excess torque. Nut can easily be replaced.



**PROTECTION** against birds and rodents is provided by this rubber cap which fits securely over the entire assembly.

## Trucking Oil

(*Continued from page 91*)

Storage facilities at Inglis power plant were sufficiently adequate so that one 80,000-bbl tank could be isolated to supply Suwannee River plant. Another feature of trucking oil from Inglis is that the plant is supplied by barge from the Tampa terminal where tanker prices are cheaper and where neither additional personnel nor facilities had to be installed.

A loading dock with pumping and heating facilities has been built at Inglis. The truck-trailer loading dock handles four trucks simultaneously. It is 80 ft long with a shed roof, 19 ft high and 21 ft wide, constructed of galvanized steel framing on reinforced concrete slabs. A storeroom on the dock houses supplies of oil and grease.

Two 250-gpm rotating plunger pumps having a discharge pressure of 50 psig and driven by a 25-hp gear motor are installed at the dock. Oil heaters of the external tube type with 420 sp ft of heating surface connect to a 6-in. strainer. Four 3-in. truck loading valves have 20-in. operating handles.

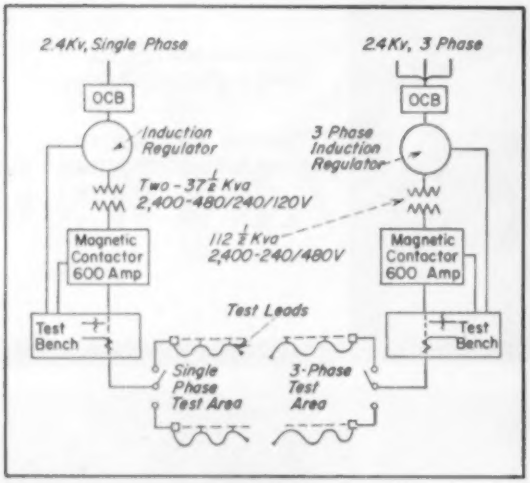
Remote control switches for starting and stopping pumps are located on the dock. Discharge valve must be held open by the truck operator, so that it can be closed immediately. Power plant employees turn on the steam and suction heaters located near the tank and start the pumps in the morning to check their operation.

Oil is transported in five 6,000-gal trailers that have a tubular coil in the tank for heating oil with steam. The trailers are pulled by tractors equipped with six-cylinder 401-cu-in. engines and five-speed transmissions. Overall length of each unit is 49 ft 5in. Drivers load the trailers and check to see that trucks are properly serviced.

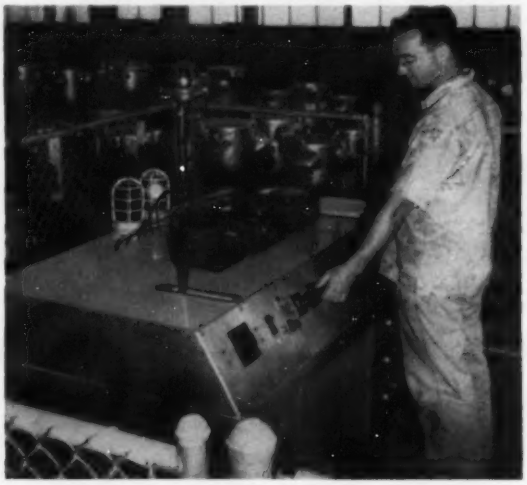
Normal shift for the truck driver is eight hours—the time required to go to Suwannee River plant and return. This distance is 230 miles, and each truck-trailer makes two round trips per day.

At the Suwannee River plant the trucks drive on a special ramp, which parallels a railroad spur. Connections, which also fit a railway tank car, are made to the trailers, and oil is unloaded by two pumps. One pump, driven by a 40-hp motor, is a 500 gpm screw type with a discharge pressure of 45 psig, and the other, driven by a 25-hp motor, is a 250 gpm rotating plunger type with a 50 psig discharge pressure. Steam tracer lines are installed in the unloading lines between pumps and tank connections. A steam hose outlet is provided for connection to the oil heater coil in the trailer tank.

The steam hose is only needed in the event the truck breaks down on the highway, causing a long period between filling and unloading. Normal temperature of oil leaving Inglis plant is 140F. After 3 hours of traveling it arrives at Suwannee at about 120F.




TRANSFORMER TESTS on single and polyphase units up to 200 kva are made with equipment diagrammed. There are four test areas



TEST CENTER is the console-type desk, with the test area in view in front and remote switching panels in back within the wire fence

# Console Desk Aids Transformer Testing

M. A. **FREDRICKSON**, Test Superintendent, Shop and Test Div, Southern California Edison Co, Alhambra, Calif.

New facilities provided by Southern California Edison Co for testing single and polyphase distribution transformers include these features:

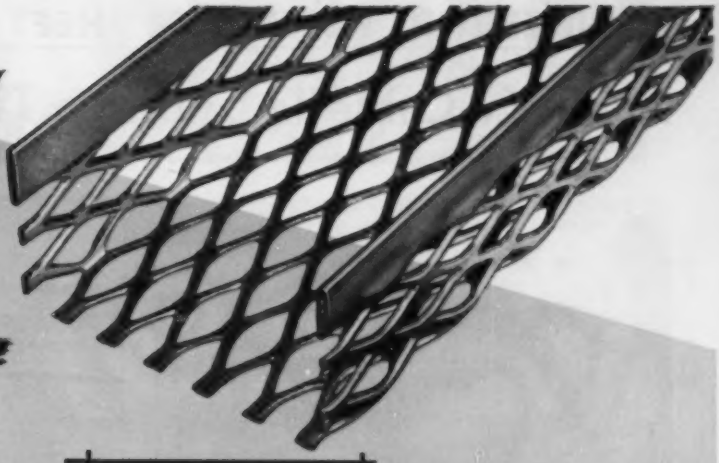
**1.** Remote control of tests from a convenient console-type test bench, with front-panel controls to minimize interference with instrument reading.

**2.** Multi-range precision instrument transformation for simplicity in metering and a reduction of currents and voltages to safe values in test bench circuits.

**3.** Electrical interlocks, safety platform, warning lights

(*Continued on page 99*)

# NEW



# DELTA-STAR Uni-Tray Cableways
## for control and power cables, instrument piping

**Delta-Star's new UNI-TRAY expanded metal cableways offer you *improved* support for your control and power cables, and instrument piping.**

The complete UNI-TRAY system provides standard fittings for any change of direction or offset in either horizontal or vertical plane—all fittings needed to erect a complete "customized" installation. Covers are also available.

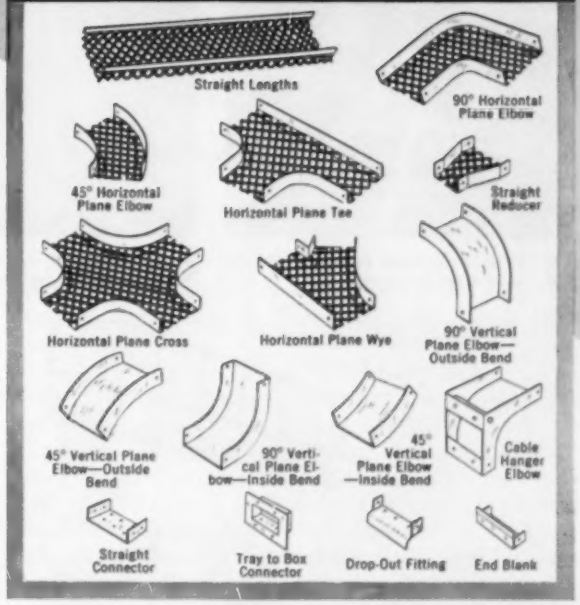
Sections are made of durable, non-corroding expanded metal—a choice of standard hot galvanized steel or aluminum. Expanded metal improves the current rating of conductors, prevents collection of water and dirt, is lightweight and strong.

Installation is simple, requiring only the use of nuts, bolts and a wrench.

The same exacting engineering, skilled workmanship and quality materials for which DELTA-STAR is famous go into UNI-TRAY Cableways. That's why you can depend on UNI-TRAYS to deliver best possible performance.

For complete information, see your nearby DELTA-STAR representative. Or, write for Bulletin 68.

**Meet all your requirements with UNI-TRAY**




*For the best in electrical equipment—specify DELTA-STAR*

## DELTA-STAR ELECTRIC DIVISION

H. K. PORTER COMPANY, INC.
OF PITTSBURGH
2437 Fulton Street • Chicago 12, Illinois
District Offices in Principal Cities

# A 35-Kv Cable Is Laid in a Tidewater Marsh

JOE FRANKENBERG, Superintendent of Underground Construction, Consolidated Edison Co. of New York Inc., N. Y.

**1** A 3-conductor, 350 Mcm, 35-kv paper-lead cable is a replacement between generating station and distant cable rack

**2** Forward end of 1,100 ft long cable is followed through marsh to prevent mishap. Cable is drawn by tractor at far terminal

**3** Cable is lubricated to ease it over ties while drawn by tractor

**4** At marsh's far end cable clears water, moves toward cable rack

**5** Concrete "chimney" is riser for cable pulled across marsh in 80 min.

**6** Cable terminated on rack is one of four lines to serve new Con Edison substation on Staten Island

Steps are illustrated in the installation of a 3-c, 350-Mcm, 35-kv, paper-insulated, lead-covered cable in a tidewater marsh. This cable is a replacement between Consolidated Edison's Arthur Kill generating station on Staten Island and a distant cable rack.

Weight, length and terrain were three problems faced. Combined weight of the 1100-ft cable on one reel was 26,000 lb. A mobile crane was requisitioned to lift the reel onto timber rigging for easy pay-out of the cable. Railroad ties were laid in the shifting mud and water. At low tide the cable was drawn across the ties by a wire rope and tractor. The crossing was made in four pulls and 80 min.

Flyash will be dumped in the marsh until the cable lays about 20 in. below the surface.

# *Here's what we mean by* SIMPLE!

## To change the ratings on this regulator, just move two limit switch pins

DO A WEEK'S job in minutes! With the *Vari-Amp* feature on Allis-Chalmers single-phase power regulators only three simple steps are needed to change ratings.

All you do is (1) open the position indicator window, (2) place the "raise" and "lower" limit switch pins in desired positions, and (3) close the window. That's all there is to it! No need to take regulator out of service. No electrical connection to make. No complicated adjustments or wiring. All other single-phase power regulators require 10 complicated, time-consuming operations to change windings.

### Get Five Ratings in a Single Unit

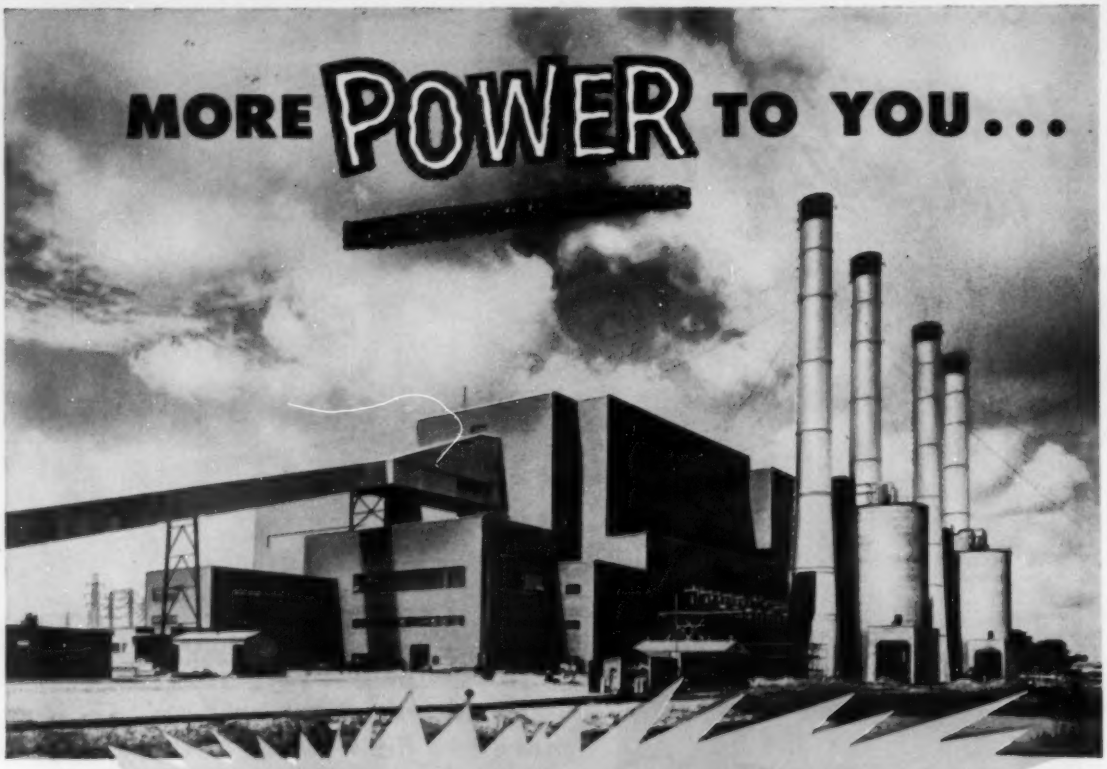
With Allis-Chalmers single-phase power regulator you get five ranges of operation instead of the usual two. In most cases, initial cost is lower because of this flexibility. And, you can increase capacity with only a proportionate decrease in range of regulation. The *Vari-Amp* feature also provides extra short-circuit capacity.

Get complete facts on the convenience, flexibility, and reliability of Allis-Chalmers single-phase power regulators. Call your nearby Allis-Chalmers office or write Allis-Chalmers, Milwaukee 1, Wis., for Bulletin 01B6065C.

A-4462

# ALLIS-CHALMERS

Originators of 5/8% Step Regulation




# Detroit Edison Plant boosts U.S. Electrical Capacity to 100,000,000 KW.

Detroit Edison's St. Clair plant boosts U. S. generating capacity to a new high. The latest St. Clair unit, rated at 156,250 kw., to go on the line brought the total U. S. electrical capacity to over 100 million kw. Shell Turbo Oil 27 was purchased as the lubricant for this unit as well as for the other three turbine generators in this plant.

Shell Oil Company extends heartiest congratulations to Detroit Edison Company for their part in achieving this industry milestone in electrical power.

Shell is proud of its long association with the great electrical industry.

**SHELL OIL COMPANY**

50 WEST 50TH STREET, NEW YORK 20, NEW YORK
100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

SHELL

## Transformer Testing

(*Continued from page* 94)

and test floor barriers for maximum safety.

With the facilities, these tests may be made on any distribution transformer up to 200 kva: Reduced voltage for short-circuited windings, exciting current, core loss, impedance, and ratio and polarity. Center of the testing installation is the console desk. It consists of a standard steel office desk with a top section of aluminum sides and formica top. This section not only raises the instruments to a more suitable level but also provides a housing and panel for components and controls. In addition the drawer space provides convenient storage for instruments, tools, test reports, etc.

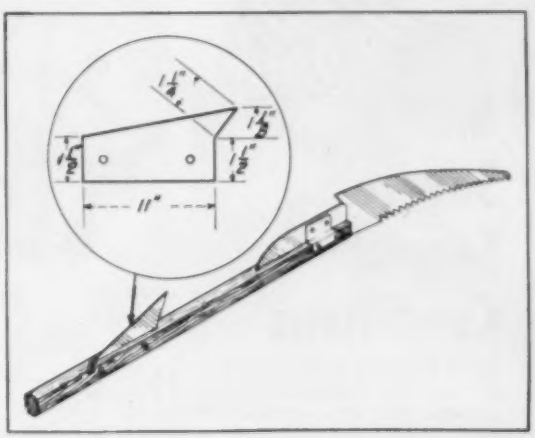
There are four separate areas in the transformer test section. Two each for single-phase and three-phase units are served from separate test benches. Switching of the supply circuit to each test area is remote-controlled by magnetic contactors from the test bench. Controls at the test position permit selection of 120, 240 or 480 v, each with regulation up to ±10%. Current ranges of 1, 2.5, 10, 25 and 50 amp can be selected through built-in multi-range current transformers. By by-passing these current transformers, up to 100 amp can be obtained for special tests. Selection of voltage and current ranges for tests automatically introduces the appropriate instrument transformations to provide the correct metering at the test bench.

Flexible, cabled, test leads between the test bench and the transformers are supported from an overhead messenger line and can be moved easily to any part of the test area. Chain hoists on an overhead monorail are used to handle covers or parts from large units. An oil pump and header centrally installed in each pair of test areas permits convenient draining or filling of units under test with insulating oil of several grades.

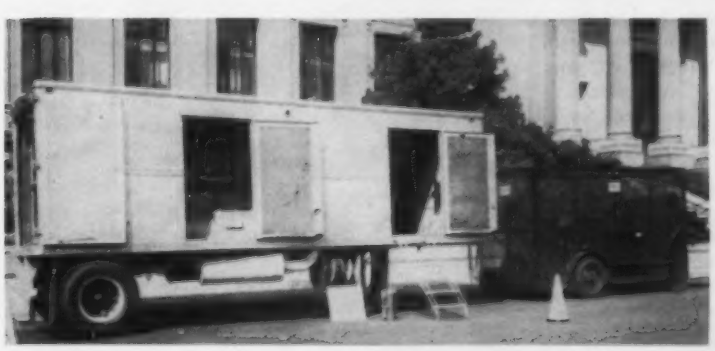
Selective controls and electrically interlocked sliding gates will "close off" either area in each pair for testing operations while the other is open for loading or unloading. Thus a maximum load factor for each test area is assured with no loss of safety. Reduction in cost of handling transformers is afforded by location of the test areas adjacent to the shop and storage facilities. Considerable use is made of modern materials-carrying equipment and trucks.

## Modified Tree Saw Pushes Cut Limbs Away

Greater safety to tree-trimming crews results when the standard tree saw is modified so that cut tree limbs may be pushed away from the operator. The modification consists of adding a piece of flat metal stock to the saw handle. The metal piece is securely attached to the handle with two ¼-in. bolts. This modification was suggested by Thomas L. Roberts and O. Bohannon in the Drum Division of Pacific Gas & Electric Co, Auburn, Calif.




## Mobile 375-Kva Generator Provides Emergency Power



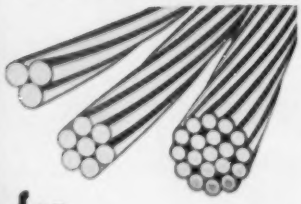
**W. E. SCHOLZ**, Senior Engineer, Electrical Engineering Div., Philadelphia Electric Co, Philadelphia, Pa.

Mobile diesel-driven generator set used by Philadelphia Electric Co provides a power source which can be quickly moved to any location over public highways. The set will be used as a source of temporary or emergency power during construction or maintenance periods.

It consists of a 500-hp, 1,200-rpm, 12-cylinder Diesel engine; a 375-kva,

ACCO Quality

PAGE Stainless Steel Strand



for Severe Service Conditions

PAGE Stainless Steel Strand is equally versatile for ground, guy and catenary applications. Its higher tensile strength, corrosion-and-abrasion resistance, elastic limit and strength-to-weight ratio make it your first choice! And—its lower cost per year of use means long-range economy.

ACCO Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Bridgeport, Conn.

PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

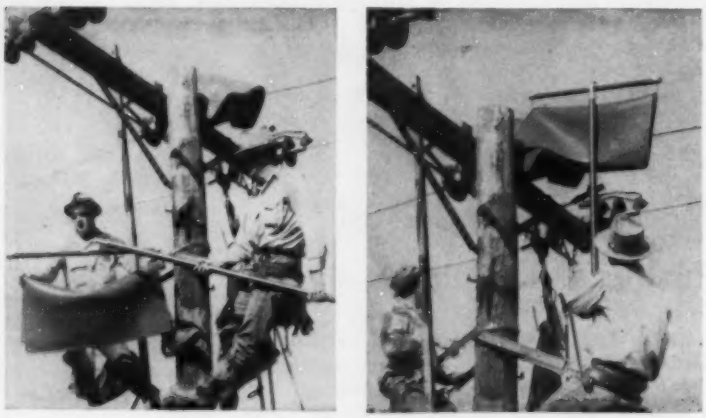
for Better Value

80% power factor, 4,160-v, three-phase generator; and necessary control equipment all mounted in a single-axle van type trailer. To keep within highway weight limits all but the bare essentials were eliminated. The trailer and some equipment are aluminum.

In addition to the usual instrumentation and protective relaying, speed and voltage regulator control is provided, so that the set can operate independently or in parallel with other generators. A 300-gallon fuel tank within the trailer is sufficient for 10-hour operation of the diesel engine at rated output. A gasoline-engine-driven air compressor and receiver tank is used normally to start the diesel. However, in cold weather ether may be required to assist starting.

Every effort was taken to reduce the operating noise level so that the set could be used anywhere. Corrective measures included a specially designed radiator at the rear of the trailer with a low-speed fan, two mufflers placed under the trailer to silence exhaust noises, and installation of fibreglass insulation on the inside walls and roof to absorb engine noise.

When the set is connected to a separate transformer trailer, power can be made available for the following additional service installations; 2,400 v two-phase, 240 v three-phase, and 240 v two-phase.



LAYING UP rubber blankets is an easier job with a new hot-line tool. The device consists of a length of hot stick wood with smooth hooks at each end. It attaches to a hot line stick

## Hot-Line Tool Aids Placing Blankets

D. MEVIS, East Bay Division, Pacific Gas & Electric Co, Oakland, Calif.

Better control in laying a rubber blanket over energized wires is afforded by a tool used by Pacific Gas & Electric Co. It saves time and effort in placing blankets, should lessen the possibility of damaging blankets, and will help maintain proper working distance from energized wires while placing blankets.

The tool consists of a 38¼-in. length of 1¼-in. hot stick wood. At each end are smooth hooks that pick up the blanket. In the center of the tool is a ⅝-in. threaded ferrule bolted to a grooved section. The ferrule is used to attach the tool to hot stick.

Smooth hooks hold the blanket parallel to the wires with its weight distributed evenly along the length of the tool. This gives a better balance on the hot stick compared with installing a blanket with a hot line clamp. Use of a clamp may damage the blanket by clamping it in the jaws.

## Toledo Uses Plug-In Walkie-Talkie in Cars

A. J. DIEWALD, Superintendent of the Line Department, Toledo Edison Co, Toledo, Ohio

Toledo Edison Co's newest walkie talkie is proving particularly valuable because of its flexibility. It can be operated from the 6-v dc car battery, a 120-v ac circuit, or built-in dry cells.

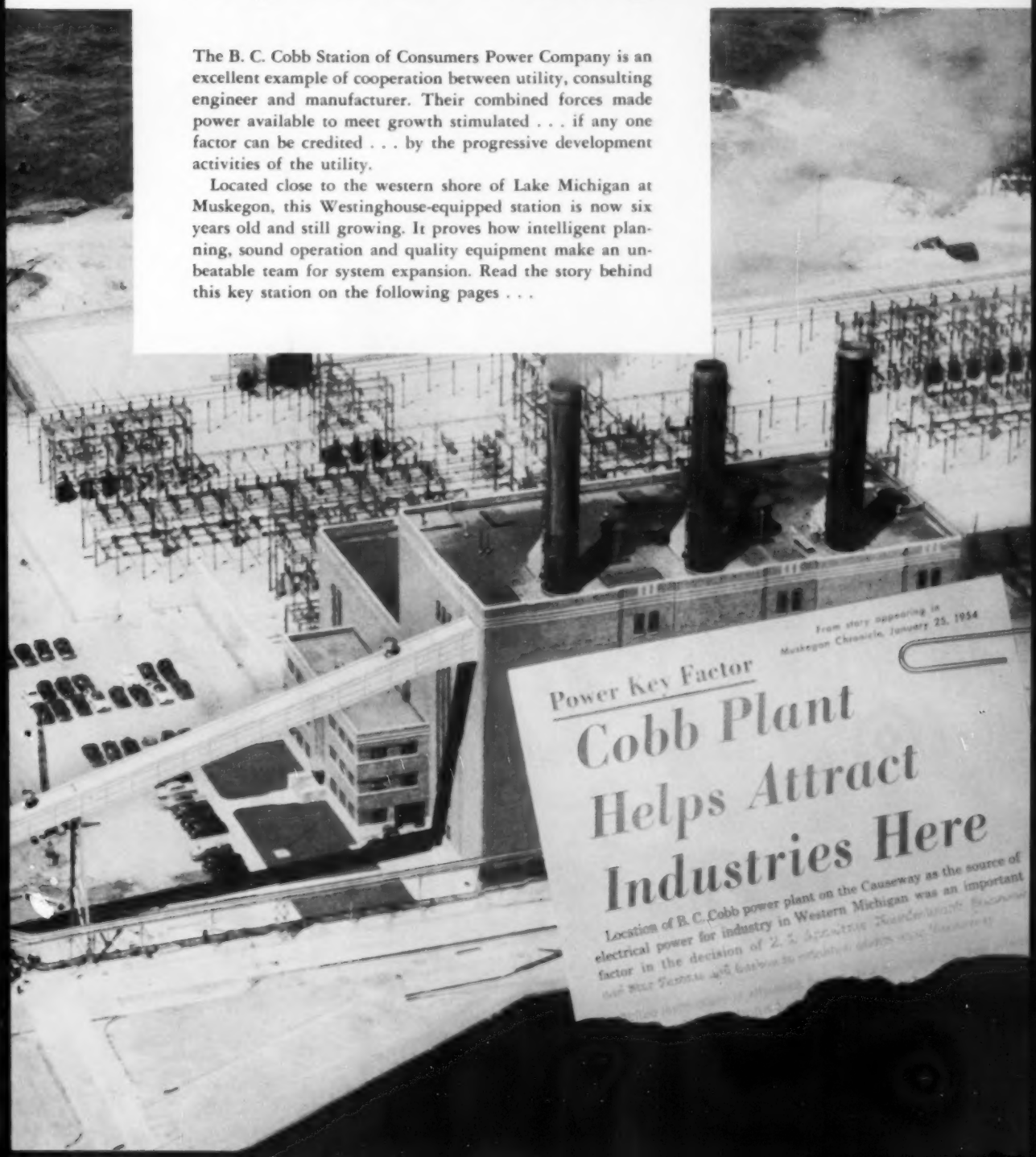
(*Continued on page* 113)

CONSUMERS POWER REPORTS:

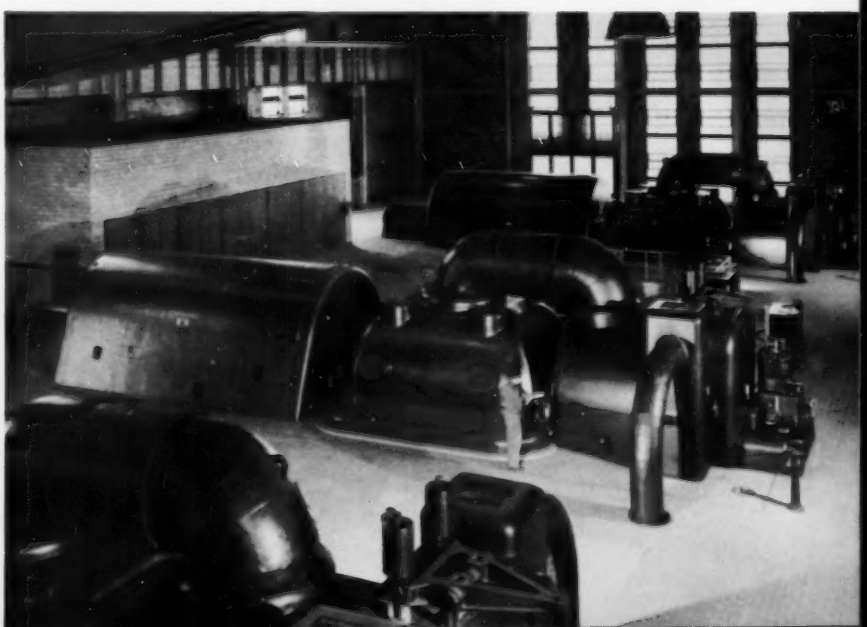
# All-Westinghouse station helps outstate Michigan grow

The B. C. Cobb Station of Consumers Power Company is an excellent example of cooperation between utility, consulting engineer and manufacturer. Their combined forces made power available to meet growth stimulated . . . if any one factor can be credited . . . by the progressive development activities of the utility.

Located close to the western shore of Lake Michigan at Muskegon, this Westinghouse-equipped station is now six years old and still growing. It proves how intelligent planning, sound operation and quality equipment make an unbeatable team for system expansion. Read the story behind this key station on the following pages . . .


From story appearing in
Muskegon Chronicle, January 25, 1954
Power Key Factor
Cobb Plant
Helps Attract
Industries Here
Location of B. C. Cobb power plant on the Causeway as the source of
electrical power for industry in Western Michigan was an important
factor in the decision of

**J. H. Campbell, vice-president,** Consumers Power Co., (center) discusses turbine blading for Unit No. 4 — 156,250 kw — with J. E. Payne, Westinghouse vice-president, and W. S. Bovard, manager of the Jackson, Mich., office of Westinghouse. Cobb Station Units 1, 2 and 3 are shown at right.



# Three-way cooperation put Cobb Station on the line on schedule . . . achieved economy in design and operation

The story of the B. C. Cobb plant goes well back into the history of the system, when the site at Muskegon was selected. The postwar potential of western Michigan dictated speed, but in early 1947 maintaining a construction schedule was a problem. Consumers Power and Commonwealth Associates found the answer in one supplier, one responsibility . . . and Westinghouse became the third partner.

W. S. Bovard, Westinghouse sales engineer, and now manager of the Westinghouse office in Jackson, went to work with the full facilities of his corporation. In addition to supplying and coordinating major equipment, Westinghouse followed through on small apparatus as well. The result: Complete standardization, with uniform reliability throughout the plant. Unit No. 1—66,000-kw nameplate, 70,425 guaranteed capability at 1.5" Hg—went on the line for commercial operation in November, 1948.

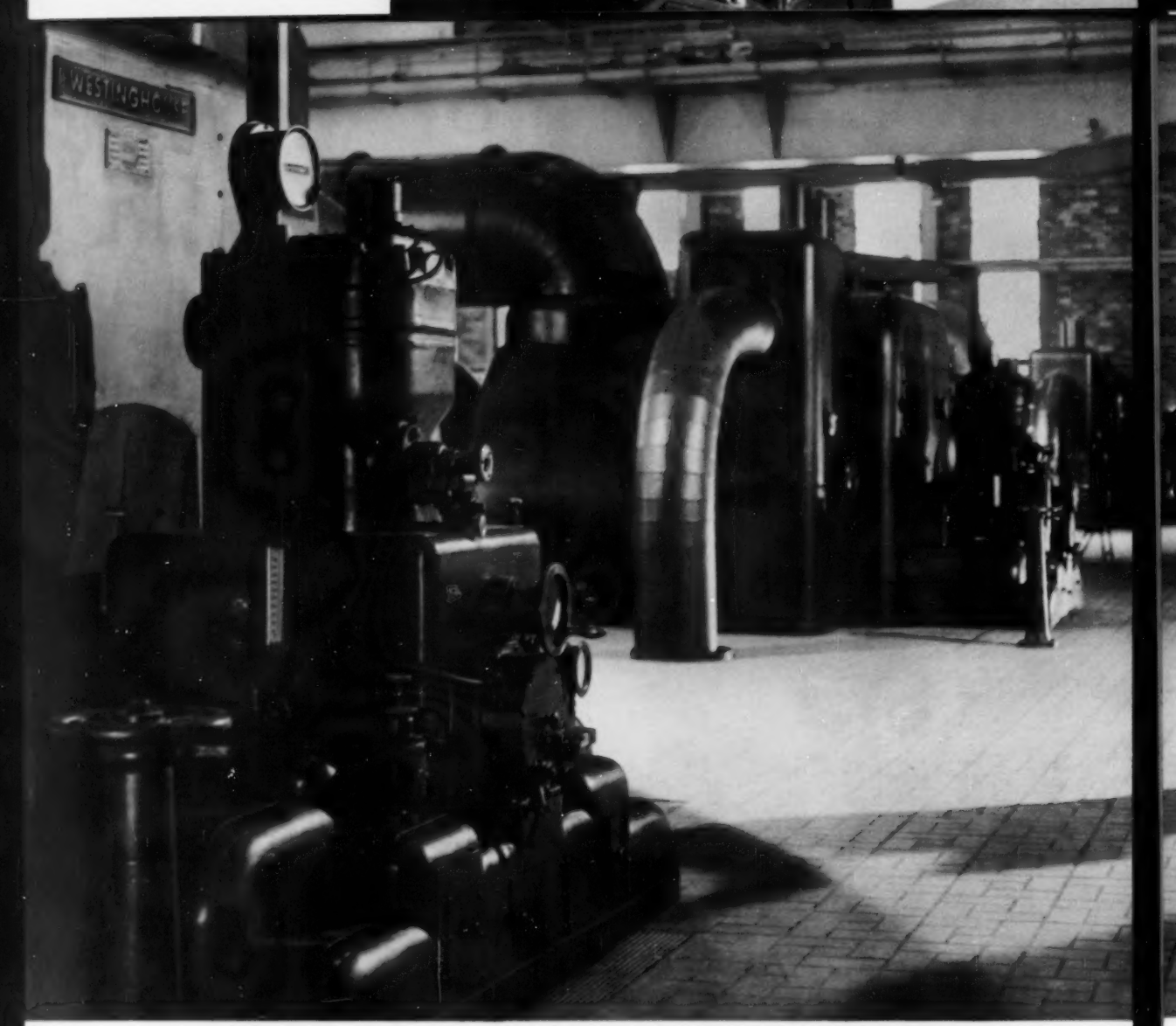
## Cost per kilowatt $110.00
## Heat rate holds firm

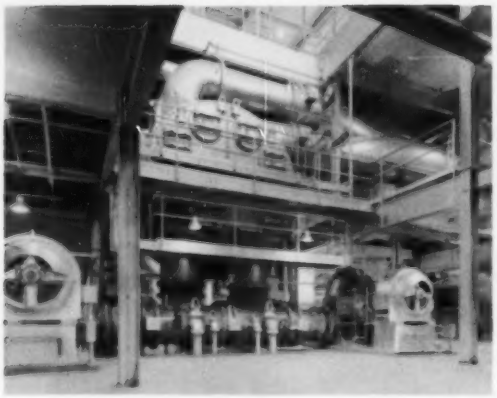
Two factors are largely responsible for this low cost and continued efficiency: Good planning and extensive use of standardized equipment. Cost proved out at $110.00 per guaranteed gross kilowatt, exclusive of substation . . . this in spite of unusual foundation expense which ran close to $5.00 per kw.

J. H. Foote, president of Commonwealth Associates, states that Cobb Station represents the most advanced design of its period . . . still turns out economical kilowatts in relation to plant investment. The heat rate holds a highly satisfactory average of about 11,300 Btu/net kwh. A total personnel of only 75 men (exclusive of coal-handling personnel) handles the 3-turbine plant on a round-the-clock basis.

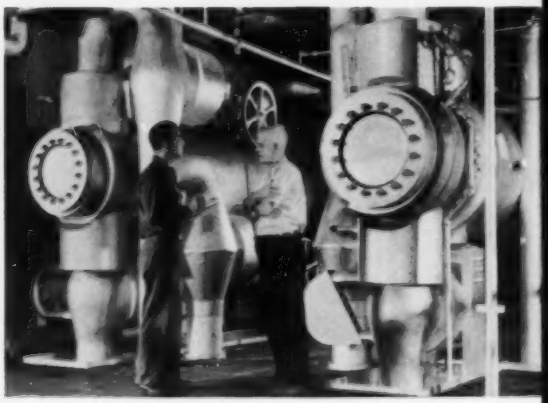
YOU CAN BE SURE...IF IT'S Westinghouse

**Key men** in the three-way cooperation which put Cobb Station on the line on schedule are C. E. Arvidson, vice-president, Consumers Power and J. H. Foote, president, Commonwealth Associates. With W. S. Bovard representing the third member of this successful team, they are discussing how reliable power from Cobb has become a key factor in supplying power for western Michigan.



**Westinghouse condenser** performance has always been highly satisfactory. Free oxygen in the condensate holds consistently within guarantee values—contributing substantially to over-all plant efficiency. In fact, this performance has become their system criterion.



**Clarence Medley,** turbine operator, and Dennis Smallegange, mechanical maintenance supervisor, check feedwater heater temperature. There are four heaters: Two low, an intermediate and a high pressure. Mr. Smallegange reports, "No tube replacements or leakage."

**The turbine-generators** at Cobb have been notable for extremely smooth operation and highly efficient governing. While Plant Superintendent Ernie Palmer (left) was showing Dick Wilson, Westinghouse sales engineer, the operating log, one of the operators volunteered: "It's a pleasure to watch these governors work. They respond promptly and you hardly see them move."

# Standardized apparatus

## ...best of current designs with proved performance, substantial savings

Extensive use of standardized equipment to attain maximum economy and speed construction is typified by the steam apparatus for B. C. Cobb Station. The three Westinghouse turbine-generators in the present station are all 66,000-kw ASME-AIEE Preferred Standard. They were among the very first preferred standards to be installed anywhere, and bore out the advantages of initial cost savings, faster delivery and easier installation.

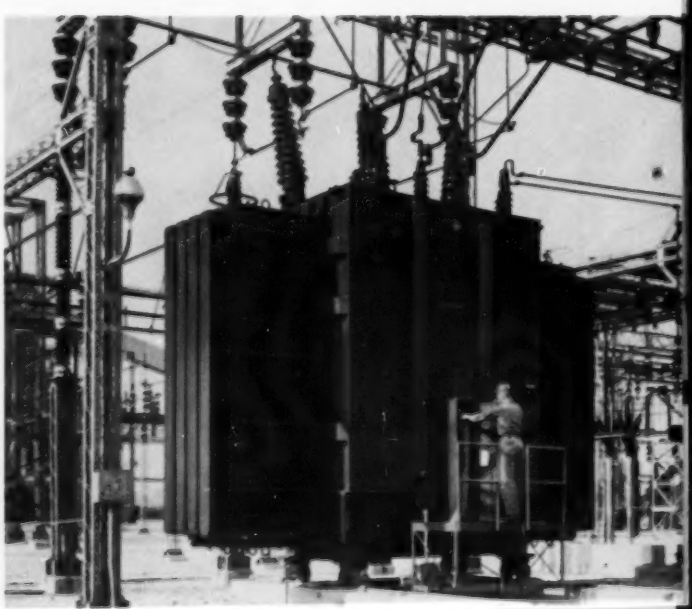
In 1956, still another Westinghouse turbine-generator will be added . . . this one a 156,250-kw guaranteed capability reheat design. With this installation, Cobb Station will have four Westinghouse units, each representing the best design of its day. Already, the three 66,000-kw units have established a fine record of reliability, being given preferred use on the system.

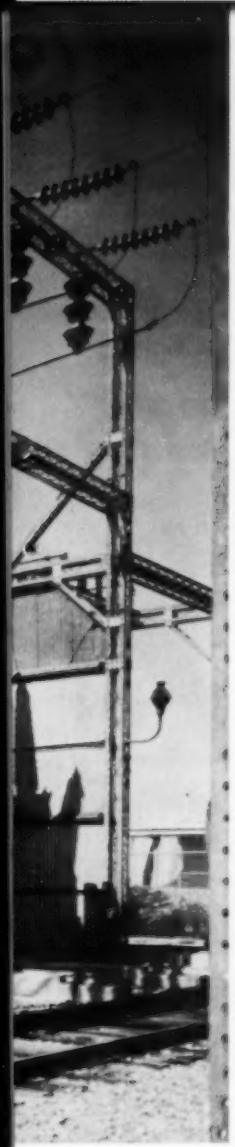
The same record for dependability has been established by the other Westinghouse steam apparatus. Condenser performance has become their system criterion, and the feedwater heater operation parallels the trouble-free operation of the other equipment. Feedwater heaters for Unit No. 4 will be the latest Westinghouse design; the high pressure heaters incorporating the exclusive quadrant head construction.

YOU CAN BE SURE...IF IT'S Westinghouse

**At Cobb Station,** "Form-Fit" design of the main power transformers allowed adequate space for side-by-side installation with the standardized station power transformers. Above, Dan Potter, electrical maintenance supervisor, and Joe Fordyce, Westinghouse Engineering and Service supervisor, review the performance record of the units, rated 75,000 kva and 6,000 kva.

**Francis Geisler,** assistant switchboard operator, checks the Inertaire® mechanism of this Westinghouse "Form-Fit" substation transformer, rated 30,000 kva, OA, installed in Cobb Switchyard.





# "Form-Fit" power transformers saved space...speeded installation

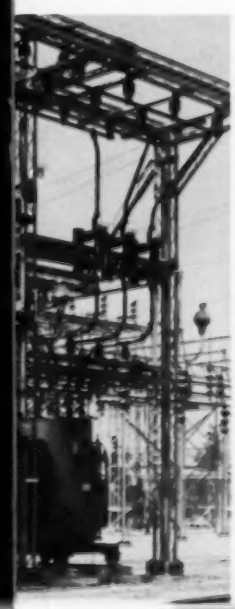
At Cobb Station, this story is legend: "When the first of these transformers came in here on its flatcar with radiators detached, it seemed too small to possibly be the capacity specified."

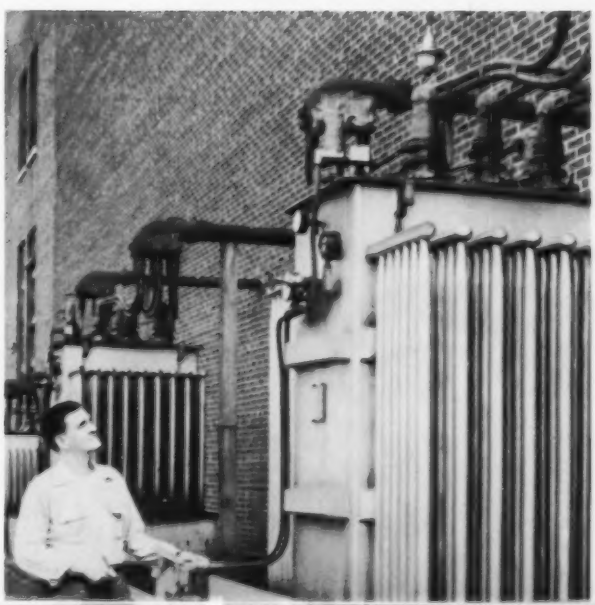
They referred to the three main power transformers, rated 75,000 kva, FOA. The extremely compact "Form-Fit" design made it possible for them to be delivered upright and, except for detachable radiators and bushings, in one piece. It also made possible installation outside the station wall in direct line with the turbines. Adequate space for installation of 6,000-kva standardized Westinghouse station power transformers was available between the main transformers.

Westinghouse "Form-Fit" power transformers consistently provide superior mechanical, thermal and dielectric properties with greater compactness than any other design. Westinghouse standardized transformers, core-form design, offer reliability with economy. Consumers Power, like many other utilities, has found Westinghouse three-phase power transformers so reliable that stand-by units are not required.

YOU CAN BE SURE...IF IT'S

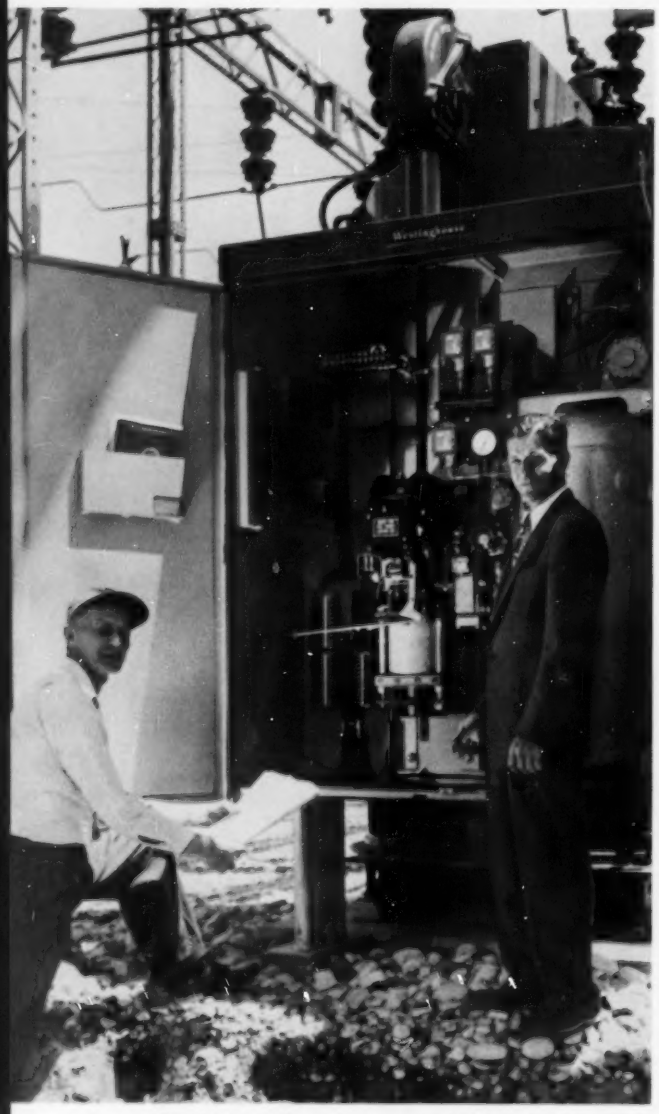
Westinghouse





**Al Witham,** assistant switchboard operator, inspects the Westinghouse "SL" 750-kva power transformers installed on the station roof. One of their own best customers, Cobb Station depends on these transformers to supply power for all 480-volt motors.

# Six-year record of "trouble-free" operation proves quality of Westinghouse breakers

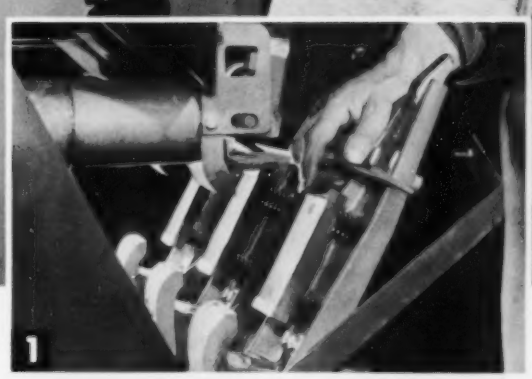


From the large-capacity, 138-kv switchyard breakers, down through the 480-volt, metal-enclosed switchgear, the breakers at Cobb Station have compiled an enviable record of trouble-free operation. In all six years of the station's history, they report only one problem: a bent stud on a contact of the 2400-volt switchgear serving the ash jet pumps . . . after the counter had recorded 18,573 operations! Because the drawout feature of the switchgear made it easy, the contact was quickly replaced. After the stud was straightened, it was returned to stock, good as new.

**Dan Potter and Joe Fordyce** are checking the diagram of the AA-10 pneumatic mechanism of a GM-5 power breaker rated 138,000 volts, 1200 amps. This breaker protects the transmission line to a new chemical plant. Potter is standing in the area excavated for the foundation of a new bank of Westinghouse GM-5's, to be installed.

**Dick Wilson of Westinghouse and Roscoe Munch,** shift supervisor, compare notes on the GM-4 breakers, 138 kv, 600 amperes. The consensus: "Once they're properly installed, these breakers are trouble-free pieces of equipment." Time and again that was expressed . . . the trouble-free operation proving quality of equipment better than any test.

YOU CAN BE **SURE**...IF IT'S

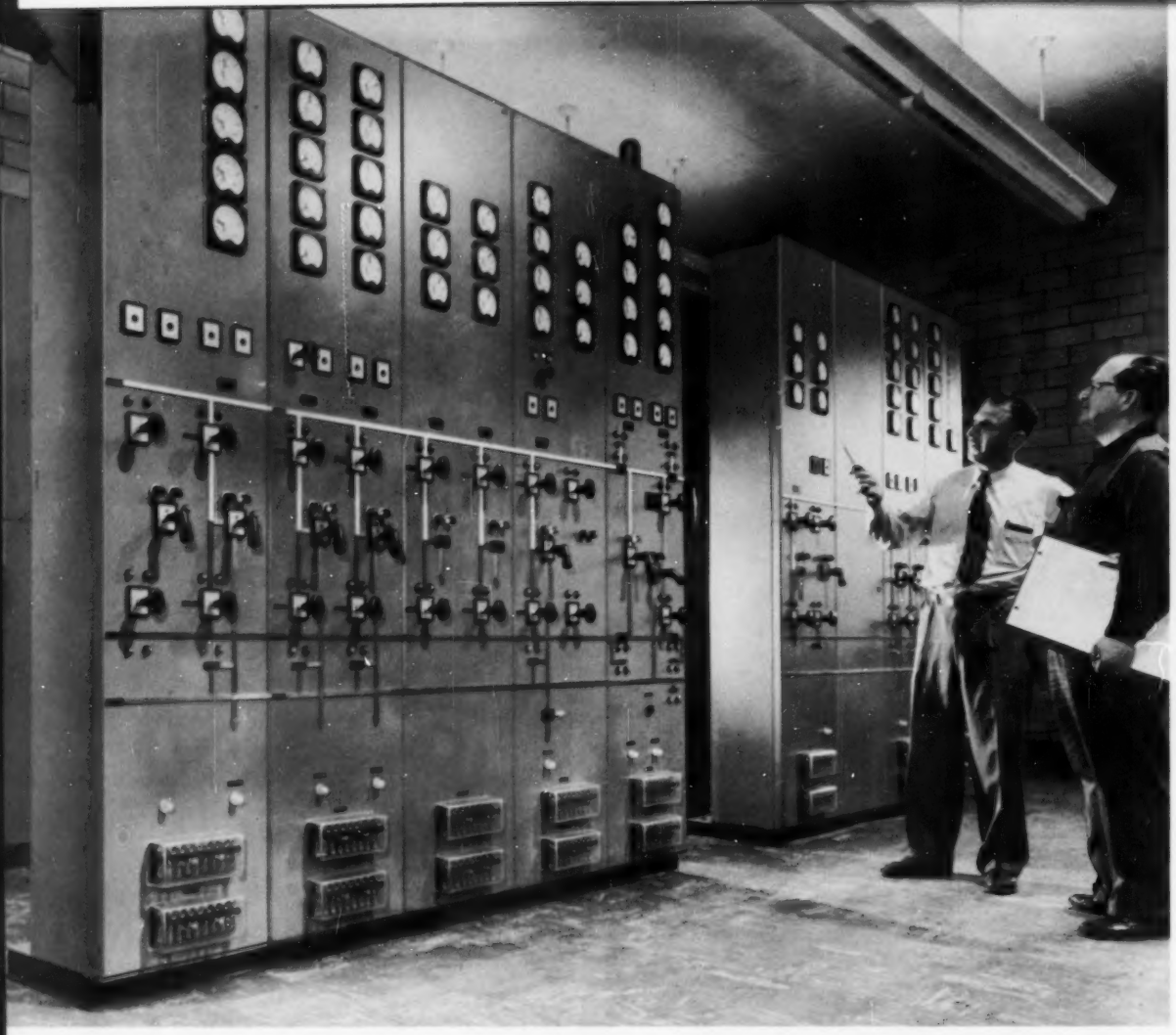


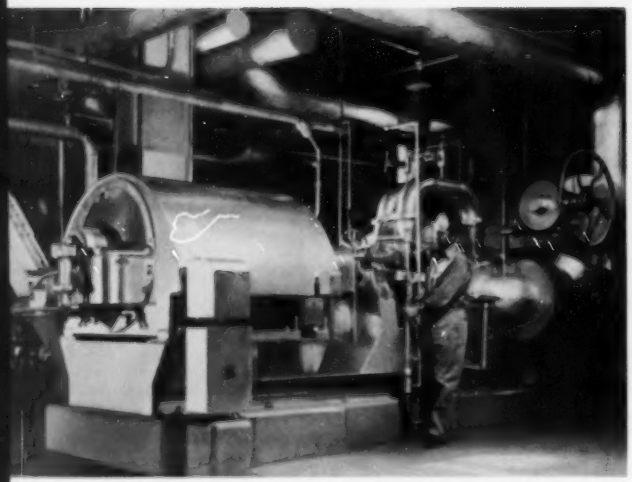

**Dan Potter,** electrical maintenance supervisor, shows how the drawout feature makes it easy for Gil Conroy to periodically check the 2400-volt breakers. This is the one breaker in the entire station that required service after 6 years and 18,573 operations.

**Close-up of the breaker** contacts in the 2400-volt switchgear. There are 34 breakers of this class in Cobb Station controlling and protecting the station's heavy electrical auxiliaries . . . with an enviable six-year record of trouble-free operation.

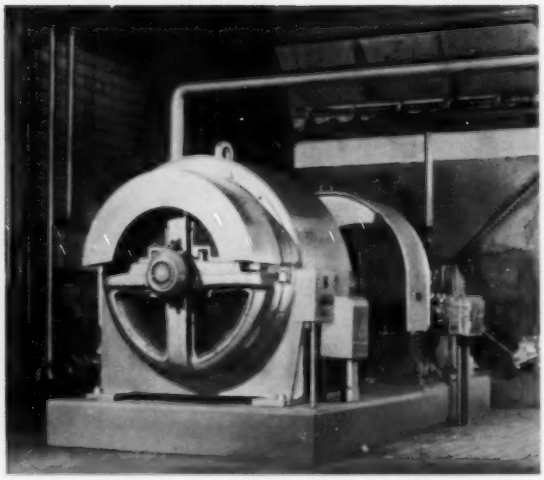
**Here's the evidence.** The damaged contact, left, had the stud straightened and was returned to stock, just as good as the new contact shown at right. Note the complete absence of pitting, burning or wear.

Westinghouse

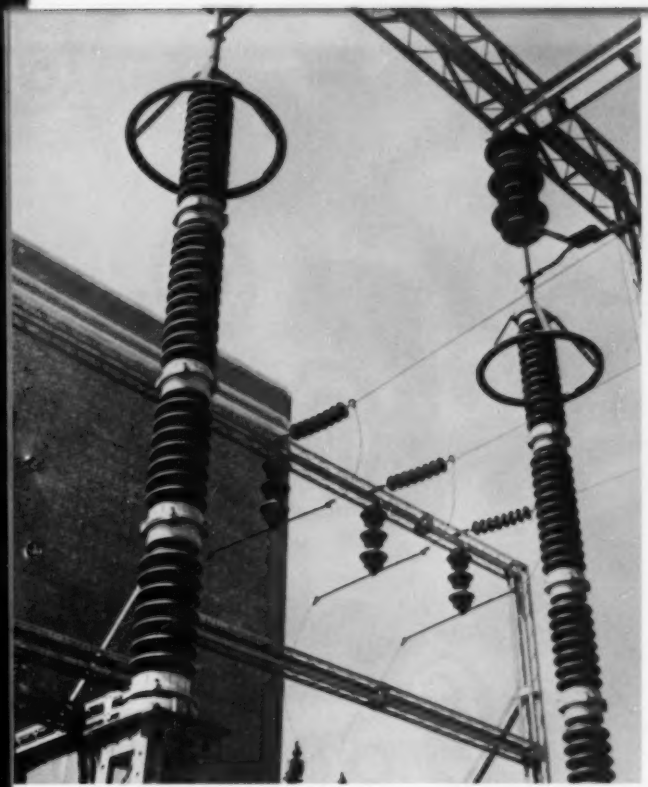




**James McCann,** assistant boiler operator, makes a routine check of bearing temperature on the Westinghouse 2300-volt, 1000-hp powerhouse motor, which operates one of the boiler feed pumps. All auxiliaries depend on Westinghouse motor drives.

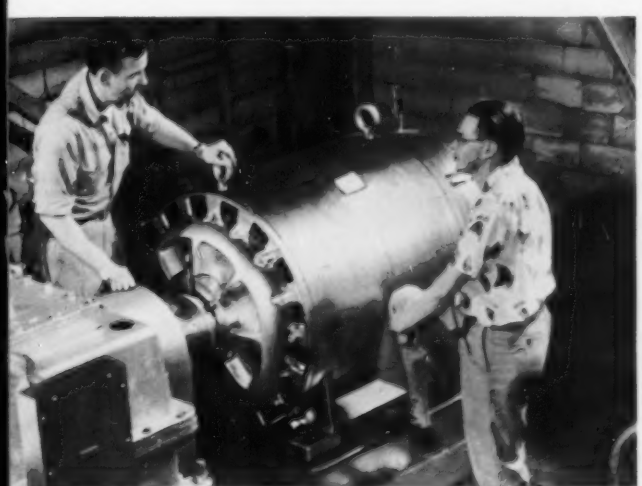


**Induced draft drives.** These standard 2300-volt, 1000-hp powerhouse motors were designed to operate in high ambient temperatures. This area of the plant averages 120 degrees . . . often gets up to 140 degrees F.



**Westinghouse SV arresters.** Six years on the line—no trouble whatsoever! How many surges? How large? The protection has been so perfect, there is no way to tell.

**Ray Franks,** shift supervisor, checks the electrical control panel with Alex Barringer. This installation was one of the first to use the new full-view Type K-24 circular scale instruments. Readings can be made at angles up to 65 degrees and without interference from glare with this widely accepted Westinghouse design.



**Douglas J. Mullen** with Harry McConnel, shift supervisor, at the 2300-volt, 200-hp induction motor in the coal house. This is an explosion-proof conveyer drive which lifts coal from the base of the pile to the bunkers, eight stories above.

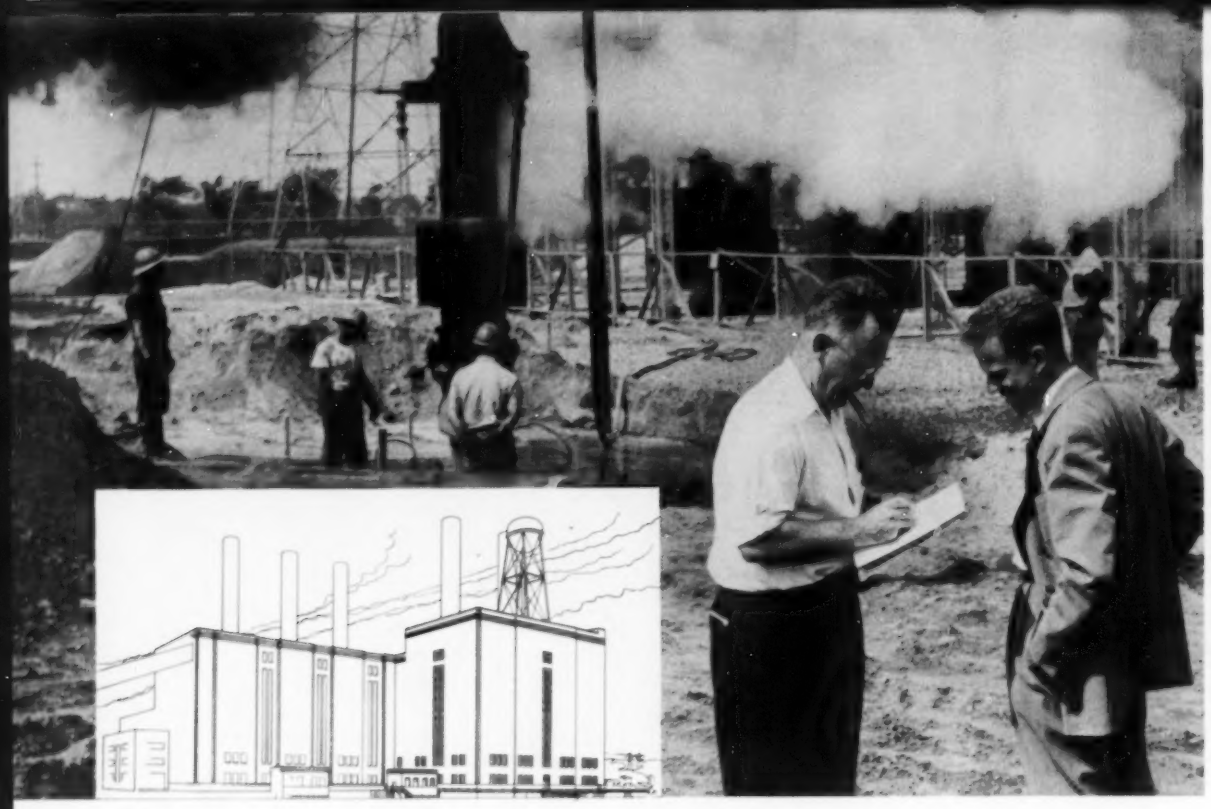
# Westinghouse reliability makes Cobb Station a top performer

Cobb Station has achieved its top performance through four prime factors: (1) Good utility—consultant planning; (2) Selection of standardized apparatus; (3) Westinghouse single source responsibility; and (4) Ability of Westinghouse equipment to meet or exceed all specifications.

Time and load growth have been a good test. To say that Cobb Station was put on the line without a "hitch" is unrealistic; but with a team of competent Westinghouse engineers on hand, every problem was handled promptly. The result: All three members of the team: Consumers Power, Commonwealth Associates and Westinghouse are proud of Cobb Station . . . prouder still of its dependable and efficient operation.

This record of Westinghouse apparatus is not unusual. But it does illustrate the extremely broad scope of products, the reliability of equipment and service, and the product engineering assistance which can help every utility in achieving the best possible performance and lowest possible cost in meeting their growing loads.

YOU CAN BE SURE... IF IT'S Westinghouse



# Still growing . . . Unit No. 4 scheduled for 1956

The planning of Consumers Power moves well in advance of the growth of outstate Michigan. With the addition of Unit No. 4, a 156,250-kw reheat unit and its 170,000-kva "Form-Fit" transformer, gross guaranteed capability at Cobb Station will be 367,525 kw—all Westinghouse.

The same cooperation which has made this station successful—utility, consultant and manufacturer—also helps them in their system planning. An Economic Loss Study, made on Westinghouse calculating facilities, is helping Consumers Power improve their operation and provide for automatic system load control.

In the photograph above, Emmett O'Meara, construction superintendent, shows Dick Wilson the technique of using watertight construction, then calculating the natural buoyancy of the plant to reduce the number of piles required for solid footing. Inset shows preliminary drawing of Cobb Station as it will appear when Unit No. 4 is completed.

## Westinghouse sales engineers, at your service

Men like Bill Bovard and Dick Wilson, who represent Westinghouse in the Consumers Power territory, are ready to serve you at any time . . . to help solve problems, get better equipment, or improve operations. Behind them are corporate facilities covering every aspect of your business, from fundamental research through manufacturing capability.

Call them at your local Westinghouse office, or write direct to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. CP-1024

YOU CAN BE SURE...IF IT'S

Westinghouse

## Plug-In Radio

(*Continued from page* 100)

A plug-in arrangement has been wired into the superintendents' cars, which are not equipped with permanent two-way radio units. The walkie-talkie can be put in the car for the time it is required. A heavy car generator is not required for operation of the walkie-talkie.

The units are used in this way for:

**1.** Wire stringing and sagging operations.

**2.** Tower erection, with one unit on the tower and one below.

**3.** Any activity requiring communications that cannot be handled conveniently without radio.

A walkie-talkie that can be plugged in on the car's electrical system eliminates the problem of batteries running down.

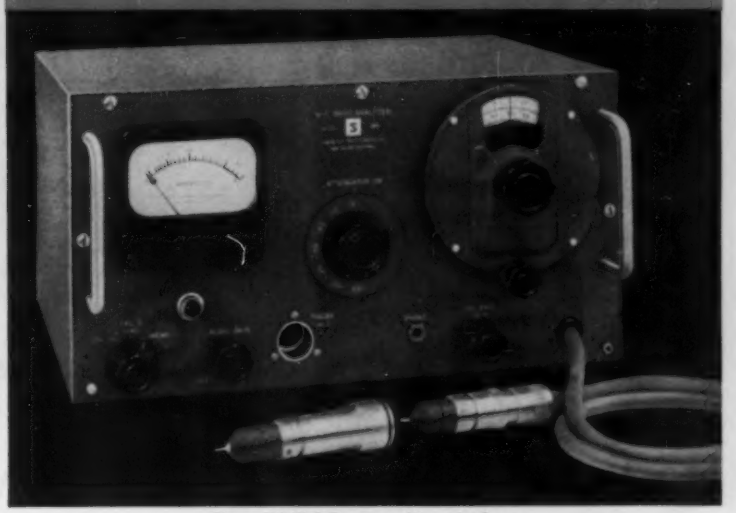
## Parallel-Blade Saw Saves Time on Difficult Job

**CHARLES KELLER**, Superintendent, Underground Dept, Toledo Edison Co., Toledo, Ohio

A parallel-blade, compressed-air saw has been used effectively on many jobs by Toledo Edison Co's crews. The two blades of this saw are 3¼ in. wide and 20 in. long.

The saw is used for sawing obstruction in tunnels, sawing off a section from a standing pole, and many other jobs. It is particulary useful for the difficult-to-get-at jobs and can only be used where the crews have a supply of compressed air.


# New hf wave analyzer!



Sierra 158 High Frequency Wave Analyzer

## Fast, convenient, 500 KC to 10 MC!

New Sierra 158 Analyzer is a highly selective, double superheterodyne receiver providing wave analysis data direct in dbm referred to 600 ohms impedance. The instrument uses a cathode follower input probe with two detachable capacity dividers for 20 or 40 db attenuation. It also includes a built-in attenuator adjustable in 10 db steps to a maximum of 60 db. These features, in combination with 22 db usable meter readings, provide a measurement range of 122 db, from —80 to +42 dbm. A measurement accuracy of ±2 db is assured for levels above —70 dbm. Spurious components from analyzer circuits are at least 50 db below fundamental. An injection oscillator at 2 mc is provided for rapid voltage calibration. A phone jack is available for aural monitoring. The instrument also includes the Sierra-designed precision spiral-scale frequency dial. ***Write for complete data.***

**SPECIFICATIONS**

**Frequency Range:** 0.5 to 10 megacycles.

**Signal Measurement Range:** —80 dbm to +42 dbm, referred to 600 ohms. (77.5 μv to 97.5 v)

**Selectivity:** 3 db down at 3 kc off; 30 db down at 12 kc off.

**Signal Measurement Accuracy:** ±2 db above —70 dbm.

**Spurious Responses:** At least 50 db down.

**Input Impedance:** Greater than 1 megohm shunted by approximately 8 μμf.

**Frequency Calibration Accuracy:** Depends on stability and calibration accuracy of the 22.5 - 32 mc variable oscillator, which is maintained within 0.25%. This results in dial accuracy ranging from ±.056 mc to ±.080 mc.

**Operating Power Requirements:** 105 to 125 volts, 50/60 cps, 95 watts drain.

**Cabinet Dimensions:** 17 inches wide, 9⅛ inches high, 13½ inches deep.

**Weight:** Approximately 40 pounds.

*Data Subject to Change Without Notice*

sierra

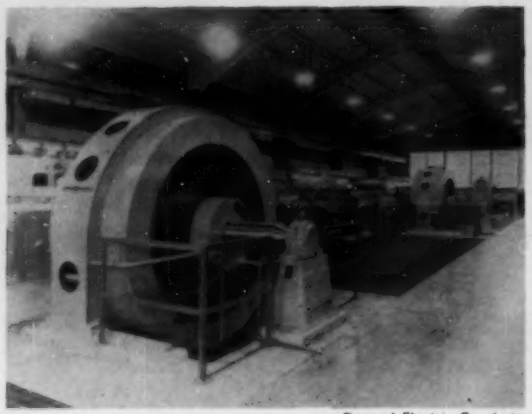
**Sierra Electronic Corporation**

**San Carlos 2, California, U. S. A.**

***Sales representatives in major cities***

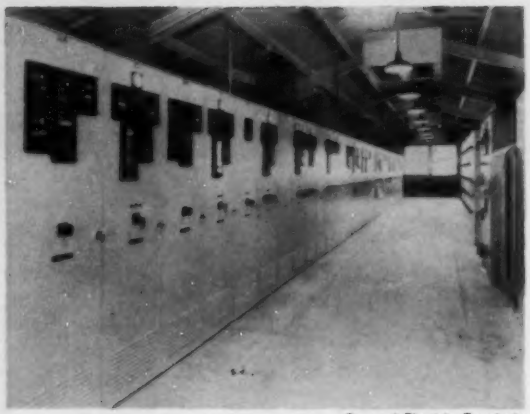
Manufacturers of Carrier Frequency Voltmeters, Wave Analyzers, Line Fault Analyzers, Directional Couplers, Wideband RF Transformers, Custom Radio Transmitters, VHF-UHF Detectors, Variable Impedance Wattmeters, Reflection Coefficient Meters.

# INDUSTRIAL APPLICATIONS



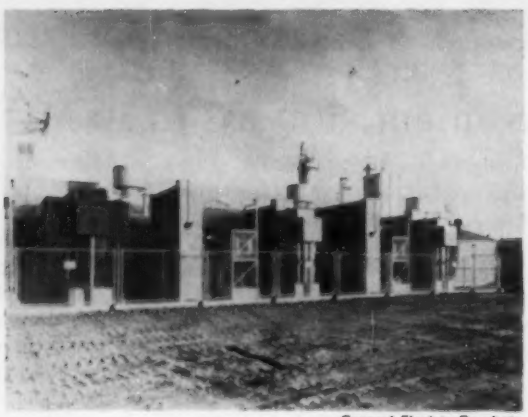
General Electric Co photo

**THIS KING-SIZE** synchronous motor, rated at 3,000 hp, unity power factor, requires 4,000 v, spins at 240 rpm, and drives a compressor



General Electric Co photo

**SWITCHGEAR** for the 4,000-v motors is shown at left. A load center unit-substation and a control center for 440-v motors are at right



General Electric Co photo

**SUBSTATION** steps down voltage from 21,600 to 4,160 v. Three-phase transformers, rated 7,500/9,375 kva each, are delta-wye connected

## 28,000 Motor Hp Powers Tennessee Chemical Plant

More than 28,000 hp of electric motors will power equipment making 250 tons of anhydrous ammonia and 150 tons of urea a day at a new Grace Chemical Co plant, Woodstock, Tenn.

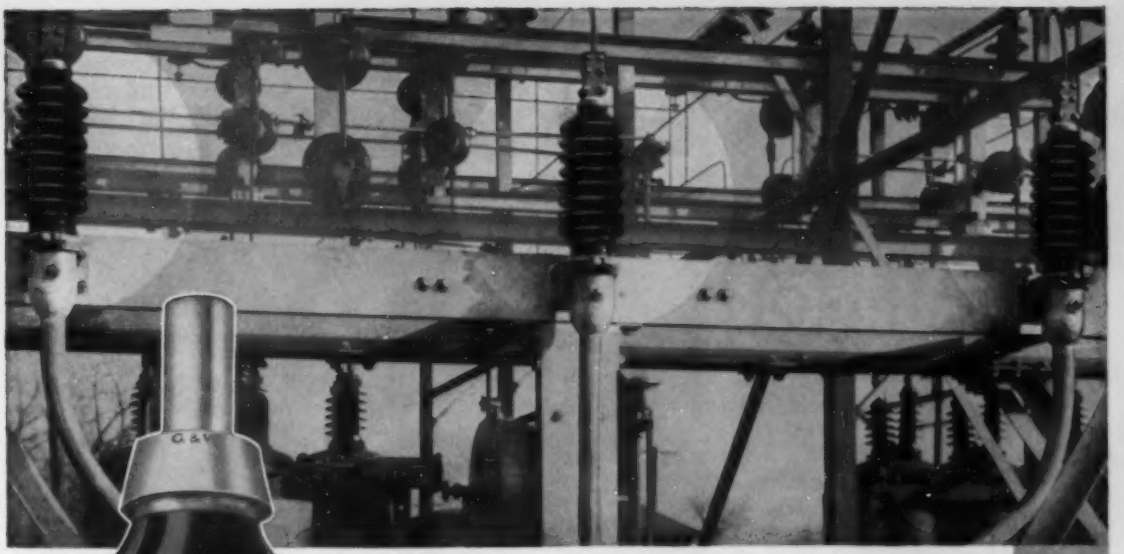
The $20-million plant is expected to have a 20,000-kw load. Motors will account for 90% of it. Three are rated at 3,000 hp each and three at 4,000 hp each. The motors drive nitrogen, air, and methane compressors.

Metal-clad switchgear, housed in an 85-ft row of 38 cubicles, had to be used because conventional motor-control equipment was inadequate.

Three 7,500-kva transformers step down incoming power from 12,500 to 4,160 v for the motors. Other distribution equipment includes three 1,000-kva and one 750-kva load center unit-substations.

## UV Lamps Banish Bacteria And Locker-Room Smells

Ultraviolet lamps serve a dual purpose in the locker room and the workmen's wash room at M. L. Bayard & Co. Inc., Philadelphia, Pa., by controlling airborne bacteria and banishing odors, to keep the rooms sanitary and pleasant. Good results are being obtained from the use of a combination of three bacteriacidal lamps and one ozone lamp in the washroom and an eight and two-lamp combination in the locker room. L. Albertson, Philadelphia Electric Co., Philadelphia, Pa.



**Assure . . . permanent protection for cable ends**

## Soldered Porcelain
# TYPE "ST" POTHEADS

These potheads are factory assembled, with metal-to-porcelain soldered joints. This method completely eliminates the possibility of future trouble due to loosely gasketed joints. When these potheads are used, the responsibility for properly sealed joints rests entirely with our factory. Troubles due to aging, cold flow and permanent set of gasket materials are eliminated.

Since their introduction in 1940, type "ST" Soldertite potheads have achieved an excellent service record on gas filled as well as standard cables. Many electric utilities companies have standardized the use of them.

Send for Bulletin AA50 (listing "ST" potheads) and for Bulletin A52 (data on makeup of stress relief cones.)

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**7780 Dante Avenue, Chicago 19, Illinois, U.S.A.**

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EVERSTICK ANCHORS...

EXTRA Holding Power

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TOUGH For long life

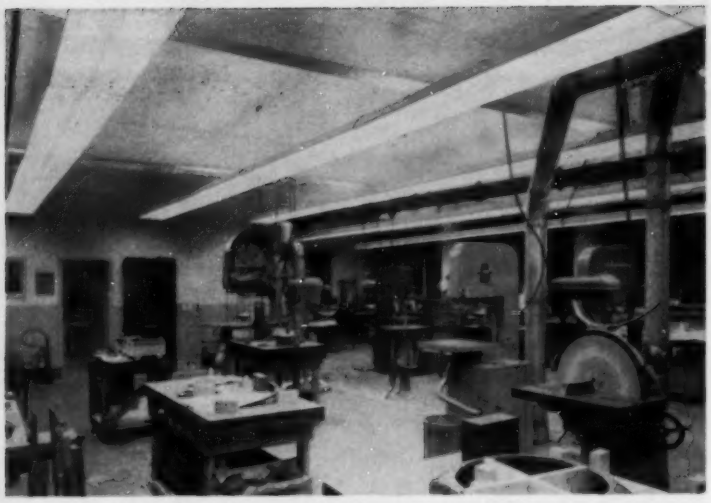
● They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all others. Available two-way, three-way, four-way, and cone types. Write for facts.

AN EXCLUSIVE
EVERSTICK
FEATURE
Exclusive Everstick nut housing. Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO.

Manufacturer of "THE ANCHOR OF MERIT"

FAIRFIELD, IOWA



DAYLIGHT FLUORESCENTS in fixtures that have 20% upward light and give 60 ft-c of maintained illumination provide high-quality lighting in pattern works to ease eyestrain

## Quality Lighting Aids Pattern Works

J. B. CLOER, Industrial Lighting Engineer, Toledo Edison Co, Toledo, Ohio

Daylight fluorescent lamps are providing a high quality of lighting at the Toledo Pattern Works, Toledo, Ohio. Mr. Rehklau, one of the owners, says he prefers daylight fluorescents because they provide the best light for seeing scribe-marks on mahogany and teakwood patterns. He also states that the installation provides freedom from glare and shadows.

The fixtures have 20% upward light and produce fairly uniform ceiling brightness. Installation provides a maintained level of 60 ft-c and is an excellent example of a quality industrial lighting job.

## Fluorescent Dusting Is Time Study Subject

A. J. BURNER, Supervisor of Cleaning Standards, Operating Department, Port of New York Authority, New York, N. Y.

It takes 1 min 59.94 sec to dust a fluorescent light for the Port of New York Authority.

A time study involving 533 lights in 10 rooms showed that 27,708 min would be required to dust the lights 26 times a year. This boils down to 1.999 min per lamp. In terms of office floor space, the figure is 25 min 6 sec per 1,000 sq ft.

Lamp maintenance is classified as "Project Work." Other such work includes washing metal and glass office partitions, and office equipment. "Daily Work" includes emptying and damp-wiping ash trays, emptying waste baskets, dusting, dust-mopping, wiping fingerprints from doors, and cleaning the boss' water bottle.

Details of the complete study were presented at the 6th Plant Maintenance and Engineering Conference in Chicago.

## Fan Exhausts Type Fumes

Exhausting fumes with a high-speed fan installed with a metal hood over type-metal machines solved a problem for the New Orleans "Item." Driven by a ⅙-hp motor, the fan exhausts heat, smoke, and fumes from the machines. This arrangement does not overload new air conditioning equipment serving the room. Engineers found that the previous window fans had to be removed as the air conditioning installation was not designed to handle the large volume of fresh air make-up necessary due to continued use of the fans. J. M. Jennings, Jr. Industrial Representative, New Orleans Public Service, Inc. New Orleans, La.

## INDUSTRIAL BRIEFS

**An electric grading** screen has upped production for General Crushed Stone Co, White Haven, Pa., by evaporating dampness from quarry raw material. Powered by a 30-kva transformer, it draws 7,400 amp at 4.5 v to maintain 150 to 160 F. Clogging vanished, so screen may last six times longer since it needs no bumping or scraping. Roland E. Edmunds, Industrial Representative, Pennsylvania Power & Light Co, Wilkes-Barre, Pa.

**Fluorescent lights** of the 8-ft industrial type have been hung over a garbage pick table operated by the City of Kansas City, Mo. Pick table illumination surpasses 100 ft-c, making it easier for attendants to spot glass, silverware, rocks, and non-ferrous metal scraps that might otherwise damage machinery or contaminate the garbage that is fed to hogs after cooking. J. E. Hovorka, Assistant Industrial Engineer, Kansas City Power & Light Co, Kansas City, Mo.

**All-artificial lighting** is a feature of a new spray painting booth installed by the Dale Gates Body Shop, Milroy, Ind. Object of the artificial lighting is to get away from the trouble in paint matching which had always been encountered because of the differences in daylight. Lighting fixtures used are three-lamp dust and vapor-tight units with deluxe cool white lamps. They are mounted at approximately a 45-deg angle at the junction of walls and ceiling. Paint drying unit is a 12-kw ceramic generator. It can be used to bake parts or the whole side of an auto plus half the top. H. B. Wells, Lighting Representative, Public Service Co of Indiana, Connersville, Ind.

**SEND IN**
***YOUR* INDUSTRIAL BRIEF**

You'll get more satisfaction from knowing your item helped someone else than from the $5 you will be paid for each item accepted. Give us the basic facts covering the application; the name and location of user; benefits, advantages, and load characteristics of the application. Mail to: Industrial Briefs Editor, Electrical World, 330 W. 42 St., New York 18.


**BERMICO**® electrical conduit was installed here because it is...

"the only product that will withstand the existing alkali condition in this area." says H. P. PELHAM,
Electrical Construction Inspector,
Salt Lake City Municipal Airport No. 1.

BERMICO FIBRE CONDUIT

Protected by over 100,000 feet of Bermico, the cables that light Salt Lake City Airport's new runway are completely safe from all natural attacks.

Made to precise standards of wood fibre impregnated with coal tar pitch, Bermico Lifetime Conduit is alkali-resistant, acid-resistant, light, tight, strong, and uniform from end to end—yet low in cost.

For the best protection for all types of underground wiring systems, follow the lead of leading public utilities and electrical contractors from coast-to-coast. Specify Bermico Lifetime Conduit. Immediate shipment of all sizes and fittings guaranteed.

**Distributed by WESTINGHOUSE Electric Supply Company**
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GENERAL SALES OFFICE: 150 CAUSEWAY STREET, BOSTON 14, MASS.

TOP—Homeowners are asked to consider age of wiring in TV ad series

CENTER—Without proper wiring, power-starved appliances are low, sluggish

BOTTOM—Home gets AW certificate and appliances are eager for action

# AW Plus TV

## It gets results for California bureau with film spots now available to you

Gloomy-faced refrigerators snap back to life. Hung-over flatirons zip into high heat.

Capers like these are being flashed on television screens in several cities and producing some measurable results for adequate wiring.

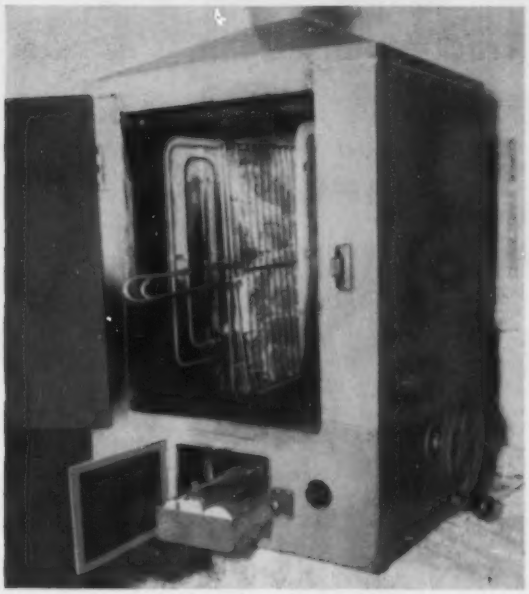
Northern California Electrical Bureau, creator of this 13-spot TV series, reports 4,000 requests for AW booklets offered during a 39-week run in the San Francisco bay area. Spots ran twice a week on one TV channel. They later drew another 2,000 responses in Fresno on once-a-week shots over a 13-week period. Now the bureau is making prints available to the trade with industry groups in Kansas City and Minneapolis-St. Paul already using them to back up their wiring finance programs.

Spots consist of cartoons, like those shown at left, backed up by tightly edited scripts of 100 words each. Asking the question, "Is Your House Dated Electrically?", each spot then goes into some phase of adequate wiring. The first points out that 99% of present homes do not have wiring sufficient to serve the appliances on the market today. The second urges homeowners to install three-wire service when building, buying or remodeling. Other spots plug use of heavy-duty circuits for major appliances, or caution against "do-it-yourself" wiring. All of them recommend the homeowner insist on receiving an AW certificate when he rewires. They conclude with advice to call the bureau or a qualified contractor.

For prints on approval, order from Northern California Electrical Bureau, 1355 Market St., San Francisco 3, Calif. Entire 13-set series sells for $390, individual sets for $30.

The bureau, however, offers some comments on their use. In its own program, contractors too many times failed to follow up on prospects that the TV spots developed. This, says the bureau, was largely because its affiliated contractors are for the most part large operators not particularly interested in the residential market. It feels reference of prospects to smaller concerns would have been better.

Another shortcoming also soon was evident. In some cases, contractors were found to be selling the job down by actually discouraging customers from insisting on an adequate wiring certificate or better standards of wiring. With this experience under its belt, the bureau plans a 26-week re-run of the series again this spring.



TWO ELEMENTS, mounted vertically, cook both sides of meat at same time. Smoking wood gives meat charcoal flavor as it cooks

# Vertical Broiler Saves Time

J. LITTON, Commercial & Industrial Sales Representative, Arizona Public Service Co, Phoenix, Ariz.

By broiling a piece of meat on both sides at once, a new vertical electric broiler, designed by the author, can cut cooking time in half.

Unit even imparts a charcoal flavor to the meat and can cook 17 T-bone steaks in 15 min, 36 hamburgers in two min. Designed in two models for commercial and residential use, both utilize two conventional but vertically-mounted cooking elements. Commercial elements are 4-kw each, residential 2 kw. They are adjustable to within 3 in. of each other to permit a variety of cooking speeds. Charcoal smoke comes from wood heated by still other elements (2-kw commercial, 1.5-kw residential) in a small box below the broiler chamber.

The cooking operation is exceedingly simple. Meat is placed in a long-handled wire grill rack and then inserted vertically into the broiler chamber. After the switch is turned on, cooking elements are moved into the desired position.

Author has patented the broiler and hopes to have it manufactured commercially.

## Largest Office Building With Heat Pumps Opened

Largest office building in the world to be completely heated and cooled by packaged heat pumps has been opened in Decatur, Ala. Thirteen 5-ton units provide year-round air conditioning for all six floors and basement of the Mutual Savings Life Insurance Co.

Because there is more than one tenant on the first floor, three units were installed to condition this area and the basement, using two zones for the first floor and one for the basement. Ducts bring return air from the first floor to the basement units. Air from floors two to six returns through doors and hallways without the use of ducts.

On the upper floors, heat pumps are equipped with a thermostat control that permits one unit to shut off entirely if only one is needed. Each floor except the first has a single zone system and is served by a large supply duct running the length of the building. This duct is covered with acoustical tile to match the ceiling. All units are located near the elevator shaft and the outdoor air ducts extend through the adjacent outside wall.

While installation costs were higher than on other systems, it was felt the operating cost (an estimated $75 per month) would more than make up the difference over a period of time. To achieve this low operating cost, engineers pointed to one main factor: elimination of water and water system maintenance costs found in conventional air conditioning systems. Heat pumps also were chosen, says General Electric Co who supplied the units, because they required only one energy source and from only one utility.

## Farms Get Power Info

"Safe Installation of Television Antennas", first in a series of seven rural electrification leaflets, is being distributed to Connecticut farmers this month by the Connecticut Farm Electrification Council.

Leaflet follows an earlier publication, "Standby Equipment in Case of Electric Power Interruption." Others to be published in 1955 include "Control of Electric Fires", "Safe Use of Fuses", "Safe Use of Electric Cords", and "Proper Grounding". Copies of the "Standby Power" leaflet are available on request from Connecticut Light & Power Co, United Illuminating Co, Hartford Electric Light Co and Housatonic Public Service Co.

## S & S Shorts

### No Second TV Says Survey

Is the market for a second TV set in every home just hopeful wishing? A recent survey showed only about 7% of TV set owners plan to buy a second set. Among reasons given for not buying another set included the house being too small, no need for another one, too expensive to have two, and too small a family to warrant use of another set.

### Electric Heat Pump Threat?

Carrier Corp has announced low-cost, year-round home air conditioning unit packaged in single, closet-size cabinet. Unit is available with either air-cooled or water cooled refrigeration and in models using either gas or oil for heating. It can be installed in new homes or replace warm air heating systems in existing homes using the same ductwork.

### New Promotion:

Hotpoint Co is inviting utilities in 100 key cities to participate in promotion of Hotpoint Living-Conditioned homes to be built this spring as part of a $2 million consumer contest.

# NEW EQUIPMENT

## Truck-Mounted Lift

A hydraulic lift has been designed to carry two men up, out, over, or down to an unlimited number of positions within its operating range. Center mast turns in either direction, inner beam can be moved to any point in an 85-deg arc, and outer beam can be spotted in any position within an operating arc of about 265 deg.

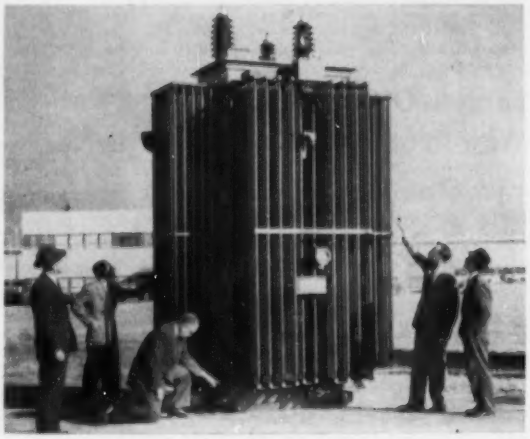
The outer beam is moved hydraulically with drive pulleys and ¾-in. wire rope. Movement of the mast and beams is controlled by levers beside the twin work baskets. A parallel linkage keeps basket floors level.

The Sky Master aerial beam is available in two sizes: Series AB-37, enabling two men to reach working areas 42 ft above the ground, and Series AB-43, providing a working height of 48 ft. The hoist is insulated against 50,000 v. Hydraulic outriggers are on each side of body. **McCabe-Powers Auto Body Co, 5900 N. Broadway, St. Louis 15, Mo.**

## Redesigned Transformers

Redesigned power transformers have improved performance and more functional appearance. They include single phase units rated 501 to 5,000 kva and three-phase units rated 501 to 10,000 kva, 69 kv and below. Newly developed materials and latest refinements in the transformer art have been applied to the redesign.

Accessories are grouped in a "control center" recessed in a shelter formed by cooling tubes. Grouping and inclined mounting of gages and instruments facilitate simultaneous floor-level reading of all indicators. Accessories requiring periodical checks are accessible even on energized units. Use of Formex wire on the windings has resulted in space savings without a reduction in dielectric strength. It also guards the windings during repairs.
**General Electric Co, Schenectady, N. Y.**



## Insulation Tester

A portable 5,000-v insulation test set features a continuously variable ac output voltage, current limiting high reactance transformer, a neon "breakdown" lamp to indicate arcing or corona in the test circuit, a neon "leakage" lamp to indicate excessive current flow, grounds and short circuits, and an accurate (+ or −3%) kilovoltmeter connected directly across the output.

Operating on 115-v 60 cps, Model 405A Hypot Junior is designed for accurate, non-destructive testing of appliances and small electrical components by unskilled operators. The instrument is housed in a welded steel case measuring 6 x 9 x 8.5 in., which is carried by a molded plastic handle. It weighs 15 lb.
**Associated Research, Inc, 3760 West Belmont Ave, Chicago 18, Ill.**

## Multiprobe Thermometer

A portable multiprobe electrical thermometer, originally designed for medical research, now is available for industrial use by engineers, nuclear scientists, chemists, and physicists. It gives instantaneous temperature readings to within an accuracy of 0.005 F, and can be obtained to cover any temperature range from −100 to 600 F.

The Multitemp thermometer does not have to be recalibrated against room temperature, nor have its bridge system balanced. It can be connected to any type of recorder when measurements are to be made graphically.

(*Continued on page* 122)

# The Most Famous Stock Number in Pole Line Hardware

The Hubbard "4-11-44" is known by its stock number from coast to coast. It's the most famous and most popular wireholder ever made.

Its popularity is no accident. It is designed on the principle, established by Hubbard 38 years ago, that for proper strength a wireholder must employ the metal parts for tensile strength, the porcelain parts for compression strength only.

The heavy, strong Copperweld bail in the 4-11-44 resists corrosion and carries the load with undiminished strength for the entire life of the wireholder.

The porcelain is designed with smooth, large-radius contours that safeguard conductors against abrasion, and a wire hole measuring ⅞ by 1-inch, sufficiently large for any service entrance wires or cables.

*The 4-11-44 deserves its excellent reputation*

HUBBARD AND COMPANY

PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA

*"Hang the load on Hubbard Hardware"*

You'll like

THIS GREAT

PORCELAIN PRODUCTS'

WIREHOLDER

MODEL 1986

AND

THESE SECONDARY SERVICE MATERIALS

You'll like Porcelain Products' metal reinforced No. 1986 wireholder. They're built to standards of ruggedness and reliability that assure top performance for generations. Metal in tension, porcelain in compression—hot dip galvanized steel parts—extra sharp, lubricated threads—large pulley-action wire hole makes this the finest wireholder on the market.

A complete line of secondary service materials built to the same high standards of quality and dependability are also available for every service installation.

You can depend on the name Porcelain Products—the byword for "Quality" for more than 60 years.

Now packaged in a handy carrying carton with real handles.

ELECTRICAL PORCELAIN SINCE 1894

61 years

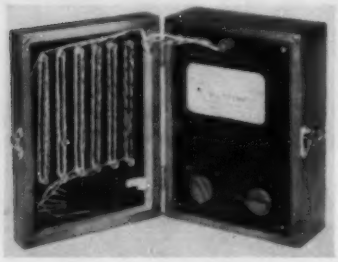
Porcelain Products, Inc.

PP INC

FINDLAY, OHIO


## New Equipment

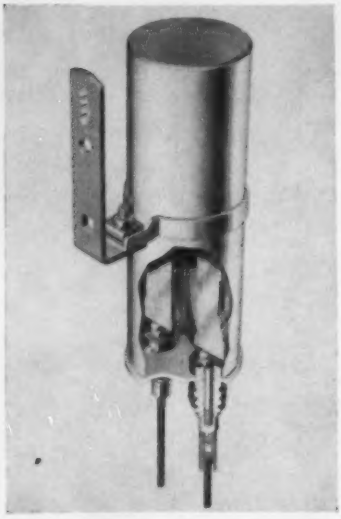
(*Continued from page* 120)



A modified design has been developed to permit automatic recording on a graph for each individual probe.

It can be used as a remote indicating instrument because its temperature leads can be longer than 1,000 ft. It can be supplied with any number of leads, enabling the engineer to obtain temperatures from many points. Little time is lost in switching from location to location because its elements respond to changes almost instantly.

**GM Mfg Co, 50 West 3rd Street, New York 12, N. Y.**



## Low-Voltage Capacitor

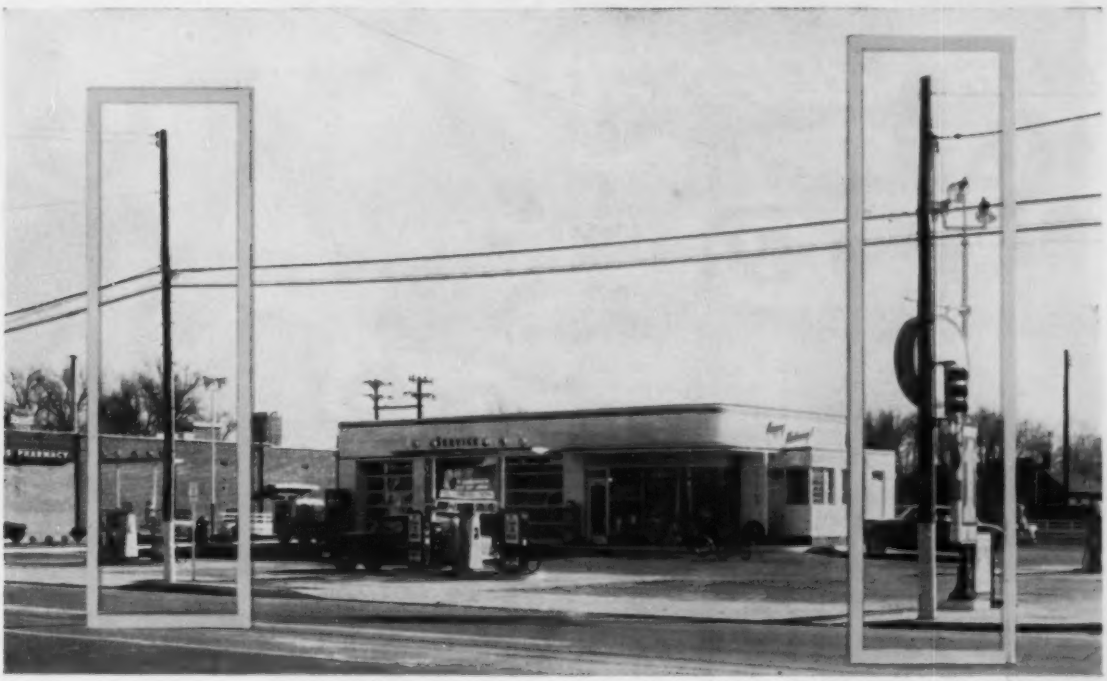
A 5-kvar, single-phase, 240-v power capacitor for secondary distribution circuits can be mounted with its terminals up or down. Type-FPS can be equipped with coordinating terminal-mounted fuses. Its aluminum case protects the capacitor from atmos-

(*Continued on page* 124)

DOW

# PENTA

## clean wood preservative protects joint-use poles from rot and termites—at no sacrifice in appearance



THE DOW CHEMICAL COMPANY
Dept. PE 844B, Midland, Michigan

☐ Send me additional information on PENTA-treated poles.

☐ Send me a list of PENTA-treating plants.

☐ Tell me how PENTA protection can actually be measured.

Name_____

Title_____

Company_____

Address_____

City_____ Zone_____ State_____

Clean PENTA-treated poles are equally "at home" on metropolitan street corners and busy farms. Whatever the conditions of use and exposure to rot and insects, poles treated with PENTA* wood preservative resist costly decay and termite attack *far better* . . . stay up *far longer* . . . cut replacement and maintenance costs sharply.

Another prime reason telephone, light and power companies and other major pole users specify PENTA: *appearance.* This modern, single-compound preservative leaves wood with a natural, attractive look. Clean PENTA-treated poles make good neighbors while meeting the most strict civic requirements.

Over 100 suppliers now provide PENTA-treated poles and crossarms carefully checked for proper retentions. Ask *your* regular supplier about the tested benefits of effective *PENTA-chlorophenol. And for new information about how simply PENTA protection can actually be *measured*, mail coupon to THE DOW CHEMICAL COMPANY, Midland, Michigan.

*you can depend on DOW CHEMICALS*

DOW

you get low-cost secondary fusing
*plus* semaphore indication with the . . .

# MATTHEWS CTS* Fuse

Here is the answer to your need for inexpensive protective fusing for secondary systems.

Matthews CTS Fuses give complete protection to secondary systems from service entrance to primary—at a very low cost. They can be used to isolate secondary capacitors, protect transformers in radial secondary systems, protect banked transformers, isolate service faults and for sectionalizing.

Picture at right shows closed view of Matthews CTS Fuse. Overall length including conductor tails is twenty-one inches. Available in a range from 5 to 200 amp. rating.

**Red Flag Indicates Outage.** The red plastic indicator on the Matthews CTS fits tight against the fuse cartridge until the fuse element ruptures. The flag is then released and instantly springs away from the cartridge. Linemen can easily spot this semaphore signal from the ground.

**Stays Intact After Operation.** Matthews Secondary Fuses do not fall apart and hang down after they blow and therefore cannot short-circuit other lines.

**Can Be Co-ordinated—Curves Available.** For the greatest possible protection on the entire system, Matthews CTS Fuses can be co-ordinated with primary fuses. Curves showing minimum melting and maximum total clearing time current characteristics are available on request.

*Cartridge Type Semaphore

**Send for complete information and performance curves today**

A·B·CHANCE CO·

CENTRALIA, MISSOURI
SAN FRANCISCO, CALIFORNIA

CF84-844


## New Equipment

(*Continued from page* 122)

pheric corrosion. Two insulated leads permit easy connection to residential feeders. The device weighs about 25 lb, measures about 26 in. from bottom to top, is about 4 in. in dia, and is supplied with a galvanized steel bracket for direct pole mounting.
**Westinghouse Electric Corp, P. O. Box 2099, Pittsburgh 30, Pa.**

## Custom Transformers

Custom made transformers up to 5 kva are available for use in ac and high-voltage test equipment and high-voltage power supplies. These oil-immersed transformers are made in 60 and 400 cps types. Their coils are impregnated with silicone oil.
**Condenser Products Co, 140 Hamilton St, New Haven, Conn.**

## Ultrasonic Analyzer

An ultrasonic attenuation analyzer has been developed to enable engineers to study the internal changes of structure in most solids and some liquids, where no apparent changes show on the surface. The device also detects flaws and irregularities in the material that may make the difference between good and bad performance. A small transducer is placed against the material to be tested. The attenuation of the signal, the signal's characteristic velocity, and the shape of reflected pulses can be read from a cathode ray tube.
**Vibro-Ceramics Corp, Metuchen, N. J.**
(*More New Equipment on page* 129)

radio began here...

Here is the original miracle upon which all wireless telephony is founded... Lee de Forest's Audion tube.

Today of course it has been improved a thousand-fold...in sensitivity, in power, in range. But this one still stands as the granddaddy of them all.

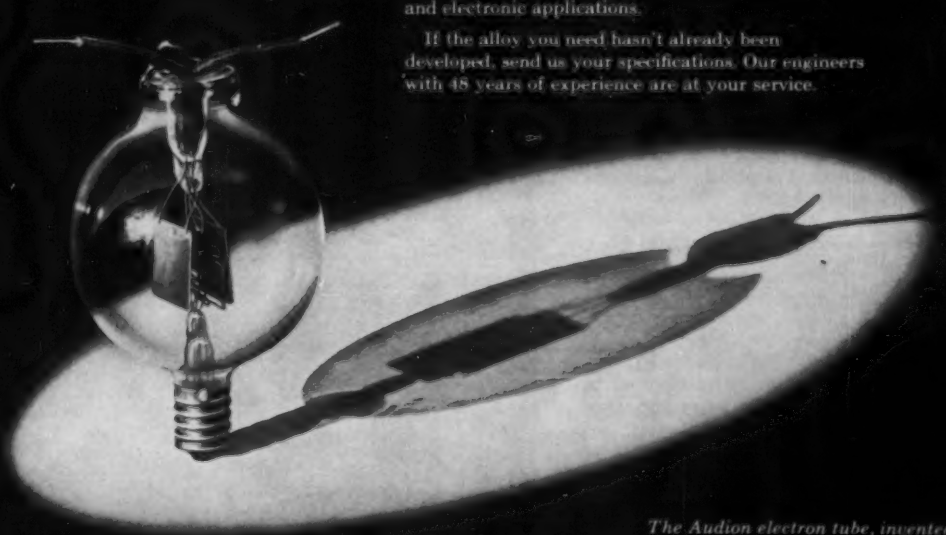
*And what has this to do with Driver-Harris? Simply this:*

The improvements on the Audion have come about through the combined efforts of thousands of devoted physicists, metallurgists, and engineers, whose increasing skills have in turn been made possible by the production of ever more effective radio alloys. Since the very beginnings of radio, the Driver-Harris metallurgists have led the way in developing these special-purpose alloys conforming to rigid specifications, upon which the performance of electron tubes so largely depends.

*With the result that today Driver-Harris sells annually more tons of radio alloys to the makers of electron tubes than does any other supplier.*

Driver-Harris makes alloys for every electronic tube requirement: for grids, plates, side rods, glass seals, cathode sleeves and tabs, socket prongs, mica straps. We offer over 80 electrical heat- and corrosion-resistant alloys for various electrical and electronic applications.

If the alloy you need hasn't already been developed, send us your specifications. Our engineers with 48 years of experience are at your service.



*The Audion electron tube, invented by Lee de Forest in 1906*

**SOME PROMINENT DRIVER-HARRIS RADIO ALLOYS:** Nichrome* • Gridnic* • Nickel "A", "D", "E", "Z", 330, 499, 599 • Therlo* • 152 Alloy • 142 Alloy • 146 Alloy

*T. M. Reg. U. S. Pat. Off.

Sole producers of world-famous Nichrome

# *Driver-Harris Company* HARRISON, NEW JERSEY

**BRANCHES: Chicago, Detroit, Cleveland, Louisville, Los Angeles, San Francisco**

**In Canada: The B. GREENING WIRE COMPANY, Ltd., Hamilton, Ontario.**

**MAKERS OF THE MOST COMPLETE LINE OF ELECTRIC HEATING, RESISTANCE, AND ELECTRONIC ALLOYS IN THE WORLD**

# How to spend less for expendables

Day after day, week after week, your instruments steadily use up charts, inks, thermocouple wires, tubes, wells—all the expendable accessories that require regular replacement.

If you've been buying your supplies on a hand-to-mouth basis, you're missing out on some sizable savings. Honeywell has developed a modern purchasing plan that gives you new economy, convenience, and quality. This new plan provides assistance in selecting the right supplies and sets up a custom-fitted schedule for buying that will cut your inventories, simplify your purchasing, and save you a big percentage of your annual bill.

### New HSM Plan

Foundation of this new plan is your Honeywell Supplies Man. He is trained in the Honeywell factory and has a broad and thorough knowledge of instrumentation. A full-time supplies specialist, your HSM gives you personalized, expert service.

These men are strategically stationed throughout the country to serve you. They will help you plan your purchases to get maximum quantity discounts . . . keep your inventories balanced and always up to date.

### Here's how the plan works

1. ***Survey plant***—Your Honeywell Supplies Man checks annual consumption of each supply item in your plant and establishes minimum inventory needs.

2. ***Detail requirements***—He then shows you what you can expect to purchase during the coming year to keep adequate stocks on your shelves.

3. ***Assist in selection***—He keeps you up to date on newest developments, and recommends specific types of equipment wherever your present buying can be improved.

4. ***Estimate savings***—Next, he prepares a blanket annual order, grouping like items to get the biggest quantity discount. Savings may run as high as 50%.

5. ***Schedule deliveries***—Finally, he arranges a regular delivery schedule that assures that you will always have adequate supplies on hand.

Give your Honeywell Supplies Man a call. He's at your local Honeywell office . . . as near as your phone.

# Load facts from *ElectronniK** recorders help "Penelec" speed

*Hilltop dispatcher's office is linked by microwave and carrier telemetering channels with each of the system's generating stations and tie points. One of the microwave relay towers stands at left behind the station.*

*Trade Mark of the Minneapolis-Honeywell Regulator Co.

*Dispatcher's-eye view of complete system power. ElectroniK instruments on the dispatcher's board in Penelec's new Hilltop Station record power generated by each of eight steam and hydro plants, total system generation, and tie line interchange, and system frequency.*

# *system dispatching*

THE minute-to-minute task of balancing changes in system load with immediate adjustments in generation and interchange has been greatly simplified at Pennsylvania Electric Company, with the completion of new centralized dispatching facilities. By means of microwave and carrier telemetering channels, vital data on station outputs, tie line interchange and frequency are brought to a single operating panel. Here these facts are accurately recorded by *ElectroniK* instruments which show the system dispatcher exactly what is happening throughout the entire power distribution and generation network.

A glance at this battery of instruments tells the dispatcher instantly everything he needs to know in order to make immediate and accurate decisions. Freed of the limitations of telephoned data, he can assign generation wherever it can be taken most efficiently . . . and thus preserves overall economy at a high level. The clearly defined trends shown on the *ElectroniK* instrument charts help the dispatcher recognize trends, and anticipate operating conditions. Human errors in observation and communication are practically eliminated.

The versatility of *ElectroniK* instruments is demonstrated by the varying types of equipment with which these instruments operate in this installation. For the telemetering of individual station generation, the recorders work in conjunction with Westinghouse Type IM telemetering receivers. Interchange at the Roxbury tie point with Metropolitan Edison is transmitted to a General Electric Type TF telemeter receiver and displayed on an *ElectroniK* instrument.

The flexibility and dependability of *ElectroniK* instrumentation can serve your own system control requirements. Your local Honeywell sales engineer will be glad to discuss your specific needs . . . and he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.

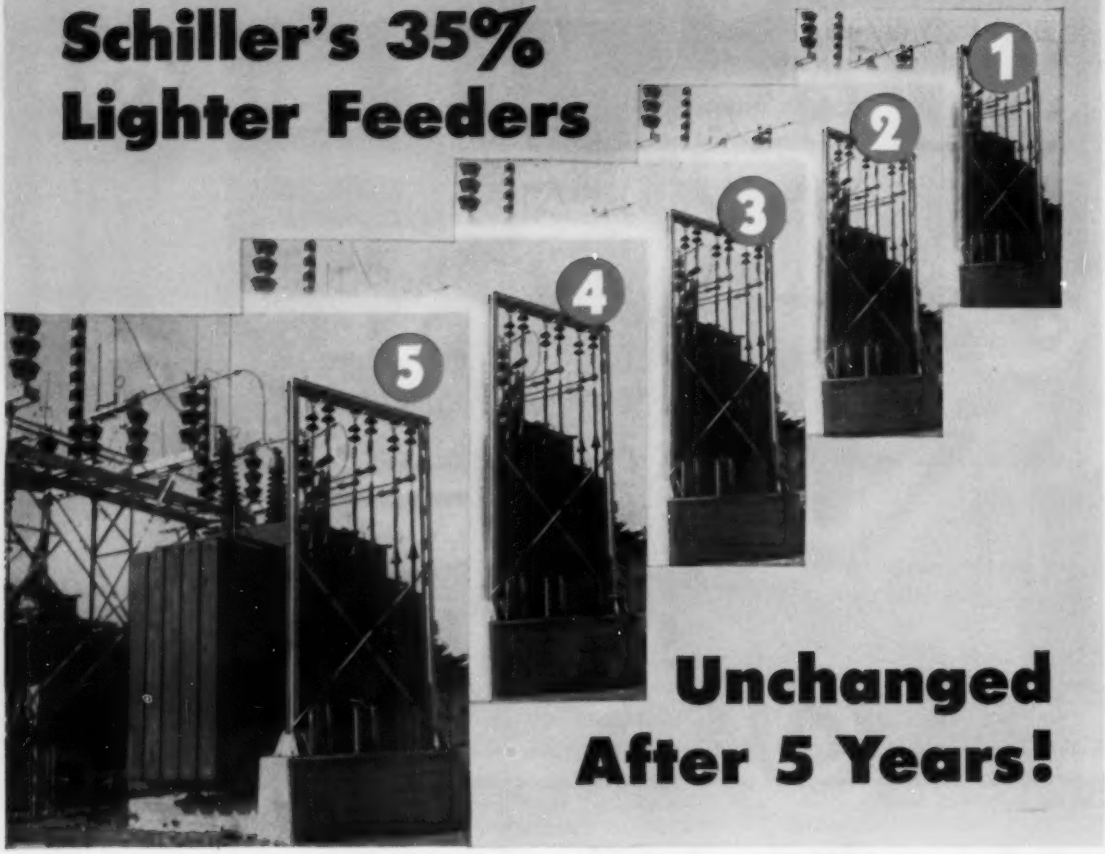
● **REFERENCE DATA:** Write for Catalog 1521, "ElectroniK Recorders" . . . and Catalog 90-2, "Supervisory Instruments for Steam Power Generation."

MINNEAPOLIS **Honeywell**

BROWN INSTRUMENTS

*First in Controls*

# Schiller's 35% Lighter Feeders




# Unchanged After 5 Years!

Five years ago Schiller Station, first complete mercury cycle power generating plant, was built at Portsmouth by the Public Service Company of N. H. Instead of transmitting 13,800 volts underground to step-up transformers through the usual paper-insulated, lead-sheathed cables, feeders of Simplex rubber insulation with neoprene jackets were installed.

By using Simplex rubber-insulated feeders, a 35% saving in weight was gained over comparable paper-insulated, lead-sheathed cable. Problems of oil migration, sheath creeping, corrosion, electrolysis, and bonding were also eliminated. Cable handling was easier because of the lighter weight and greater flexibility. Splicing and terminating was faster since there were no lead joints to wipe.

Recently Schiller Station, and its Simplex feeders, completed five years of uninterrupted operation. The Simplex cables appear to be in as good condition as when they were installed. They've given dependable service despite heat, oxidation, and ozone conditions of high voltage transmission. Their water absorption is low, and their resistance to soil acids and weathering is high.

Your high voltage transmission problems can be solved the same way as Schiller Station's with Simplex rubber insulations like Anhydrex XX. A synthetic rubber insulating compound, Anhydrex XX is designed for power circuits in the 2,001 to 25,000 and over voltage range. Write to the address below for more information.

*Simplex*-ANHYDREX XX

SIMPLEX WIRE & CABLE CO., 79 Sidney St., Cambridge 39, Mass.

# Photoelectric Tester for Watthour Meters

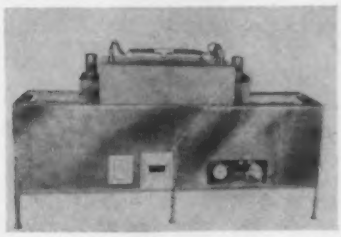
Photoelectric equipment for testing watthour meters incorporates a new cadmium sulfide cell that provides greater flexibility and accuracy. Measuring ⅛-in. dia and mounted on a ⅛-in. tube, the cell has a high sensitivity.

Using the meter tester, the sensitive cell and light source can be set 3 to 4 ft apart. This permits many meters to be tested without adjusting the sensitive cell and light source between tests.

Accuracy is based on one revolution plus or minus 0.004%. Maximum revolutions of the testing disk in one test cycle is 20 revolutions at two impulses per revolution, and 40 revolutions at one impulse per revolution.

The tester is available in portable and switchboard types. Both have a power source of 120 v, 50 to 60 cps, and a net weight of 37 lb.

**General Electric Co, Schenectady 5, N. Y.**



## Far-Infrared Oven

A continuous production soldering oven uses three far-infrared electric radiant heaters to solder equipment passing through it on a stainless steel conveyor belt. Far-infrared has a longer heat wave and produces a faster warm up.

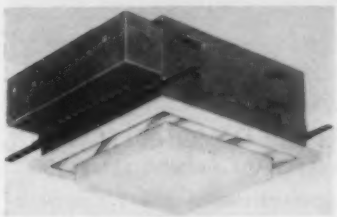
Each 1,100-w heater and the ¼-hp motor has its own on-off switch with 15-amp magnetic circuit breaker. The conveyor can be moved at five speeds. The heaters, which give a density of 40 w per sq in., can be adjusted up or down. Operating heat can be maintained through short non-working periods by one heater.

**Electrical Industries, 44 Summer Ave, Newark, 4 N. J.**

## Fractional HP Motors

Small, lightweight motors rated from 1/6 through ½ hp now are available in NEMA 48-frames, which are ¾ in. lower and 1 in. shorter than NEMA-56 frame motors having the same ratings. Mountable in a variety of positions, the motors feature straight-through ventilation. A unique terminal board design on the single-phase motors permits change of voltage or motor reversal through interchange of quick-disconnect plugs in the motor conduit box. Flexible leads between motor windings and terminal boards are eliminated.

**Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.**



## Recessed Lights

A series of pre-wired, recessed incandescent light fixtures are available in square and rectangular styles. These well-vented fixtures vary from 60 to 300 w, and can be outfitted with Fresnel, Cast Opal Glass Bowl, Semi-Flushed Dropped, Corning Alba-Lite, and Fota-Lite lenses.

Duraflux fixtures feature a one-piece aluminum reflector. The lens frame swings open on hidden hinges when its vibration-proof spring latch is released, facilitating maintenance.

The fixtures are designed for use with R, T, TW and similar low-cost building wire, which can be run directly to the wiring compartment. Ask for Architectural Bulletin 555F.

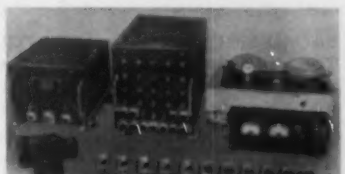
**Litecraft Mfg Corp, 8 East 36th Street, New York 16, N. Y.**

## Protective Coating

Micro Lite ML 88, an abrasion-resistant coating, cures at room temperatures and may be applied by brushing, spraying or dipping. Originally developed as a rain-erosion-resistant material, ML88 has a dielectric strength of 1,000 v per mil, and will not crack or break under flexing at minus 65 F. A fully cured film may be subjected intermittently to 400 F without deformation.

It can waterproof auto ignition systems, protect wiring harnesses and panels subject to abrasion, and encapsulate resistors, transformer windings and relay coils.

**Radar Relay Inc, 2260 Westwood Blvd, Los Angeles 64, Calif.**



## Gas Detector

Used to detect explosive gas accumulations caused by firing guns in military planes, a gas detector now can be adapted to industry for making quantitative measurements in certain air-gas mixtures.

It permits continuous sampling at 10 test locations through use of 11 heated platinum filaments connected to a Wheatstone bridge circuit. One

when it
comes to
line clearance
**BRUSH KILLERS**
you name it . . .
**THOMPSON**
makes it!

Thompson, one of a handful of America's basic manufacturers of selective herbicides, makes every type of proven efficiency — ready for your use — whether you employ foliage spray, basal bark or stump treatment.

LOW VOLATILE

**BRAMBLCIDE 5 — L. V.**
**2,4,5-T**

**BRAMBLE-WEEDICIDE 5 — L. V.**
**2,4-D — 2,4,5-T**

CONTROLLED VOLATILITY

**BROAD SPECTRUM — PENTYL ESTERS**

**BRAMBLCIDE**
**BRAMBLE-WEEDICIDE**
**BRAMBLCIDE 5**
**BRAMBLE-WEEDICIDE 5**

BROAD SPECTRUM . . . or LOW VOLATILE . . . whichever you prefer, Thompson's delivers *more kill per gallon* because every gallon is fortified with a new and exclusive surfactant perfected in the Thompson laboratories. No other "creeping agent" duplicates its performance.

MORE GALLONS PER DOLLAR . . . when you specify Thompson you get a finished product from the basic producer . . . your most economical method of buying.

for most efficient kill at lowest cost*

SPECIFY . . Thompson Chemicals FIRST NAME IN BRUSH KILLERS

*Write for station paper 19. It provides latest research on right of way herbicides, their selection and application.*

**THOMPSON CHEMICALS CORP.**
St. Louis 3, Mo. Los Angeles 27, Calif.

*agents in principal cities*

filament serves as a reference. Time response is less than ½ sec. The shock-mounted device works at temperatures of minus 40C to plus 60C, and its vacuum system enables it to work up to 40,000 ft of altitude.
**Bristol Engineering Corp, Beaver Dam Road and Oak Lane, Bristol, Pa.**

## Amp-Traps

Amp-traps for 480/277-v underground systems protect cable and associated equipment against faults of both high and low magnitude, yet permit continuous operation at full normal rated ability. The 4/0 and 500 Mcm CP-6 Amp-traps are rated at 100,000 rms amp interrupting capacity. But they can stop shorts as high as 200,000 amp at 535 v. The CP-6 limits the fault current to about 10% of its maximum available value and clears the fault completely in less than one-quarter cycle. When the 4/0 and 500 Mcm Amp-traps are connected in series, the 4/0 will blow and the 500 Mcm will not, thus isolating the fault to a particular tap or feeder.
**Chase-Shawmut Co, Newburyport, Mass.**

## All-Purpose Welder

A combination arc welder, called Idealarc, provides ac or dc welding current in a soft type or digging type of arc. This flexibility enables the user to select the best arc for welding ferrous or non-ferrous metals, sheet metal, or heavy plate. Current models available are 300, 400 and 500 amp ac combined with dc capacities of 200, 300, 375, and 450 amp. It can also be obtained as an ac unit, to

which a dc "package" may be attached in about an hour when desired.

**Lincoln Electric Co, 22801 St. Clair Ave, Cleveland 17, Ohio**

## Temperature Control

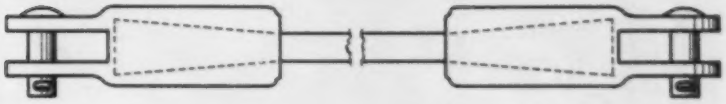
An indicating temperature control combines an independent dial thermometer with a differential expansion type temperature control that operates a snap-action switch. The switch in the Model LD-1S is rated at 15 amp, 125-250 v ac. Operating differentials are from plus or minus 1 to 4 F. Several adjustable temperature ranges are offered, including a 150-750 F range. Bulletins, Form 334.

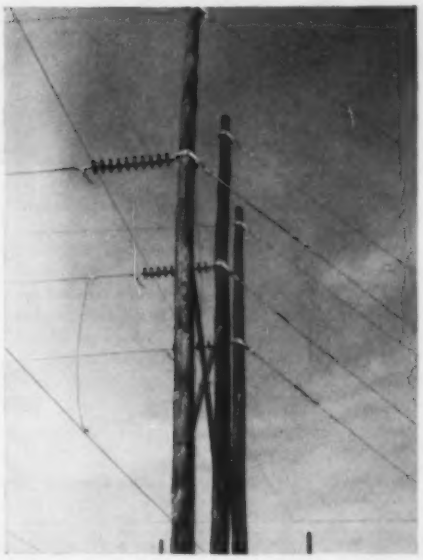
**Burling Instrument Co, 16 River Road, Chatham, N. J.**

## Recloser Checker

A portable test instrument for checking and calibrating reclosers, sectionalizers, overload relays, fuses, and CSP transformer breakers is rated at 4 kva in models that operate on 220 or 440 v, 60 cps. Using low voltages, Model 2040/ACTS is said to


AUSTIN PREGWOOD **SAFETY STRAINS**





**PREGWOOD**

*is a completely stable material for use in*

***GUY WIRE INSULATION***

• From the standpoint of appearance, low storage cost, and long life, the Pregwood Safety Strains are the most economical guy strain insulators available. To test them is to prove it.

When you use the Austin Pregwood Safety Strain Insulator you find that you eliminate the problems usually associated with suitable guy wire insulation.

The Austin Pregwood Safety Strain Insulator furnishes the first effective answer for a low-cost, high strength, non-weathering, inconspicuous guy wire insulator. Because it is non-weathering and will not absorb moisture, arcing horns have been completely eliminated. The self-tightening head, developed by Mr. A .O. Austin, takes full advantage of the inherent strength of Pregwood which is also non-shattering.

Write for full details.

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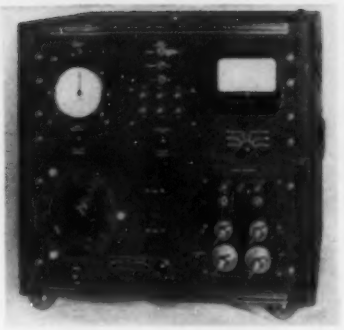


be suitable for automatic testing General Electric, Kearny, Kyle and Westinghouse oil circuit reclosers for minimum trip current, sequence operation, and coordination.

Its output is adjustable in stepless increments from 0-1,000 amp at 0-4 v, 0-500 amp at 0-8 v, 0-250 amp at 0-16 v, 0-100 amp at 0-40 v, 0-50 amp at 0-80 v, 0-33 amp at 0-120 v, 0-25 amp at 0-160 v, and 0-12.5 amp at 0-320 v.

**Multi-Amp Corp, 10 Third Street, Newark 5, N. J.**

## Service Cables

Increased current carrying capacity, better appearance and heat-resistant insulation are featured by two three-wire service entrance cables. They are Type SE Style U and Type SE Style A. The 75C copper temperature of the cables yields a larger current-carrying capacity than former cables of the same size. A special aluminum paint finish adds a clean, bright appearance to the cable.

**General Electric Co, Construction Materials Division, Bridgeport 2, Conn.**

## Portable Generator

A portable lightweight generator for emergency service can be carried by one man, and is rated 1,500 w — enough to operate small tools, floodlights, deep freeze units, electric pumps, or any other small electrical equipment.

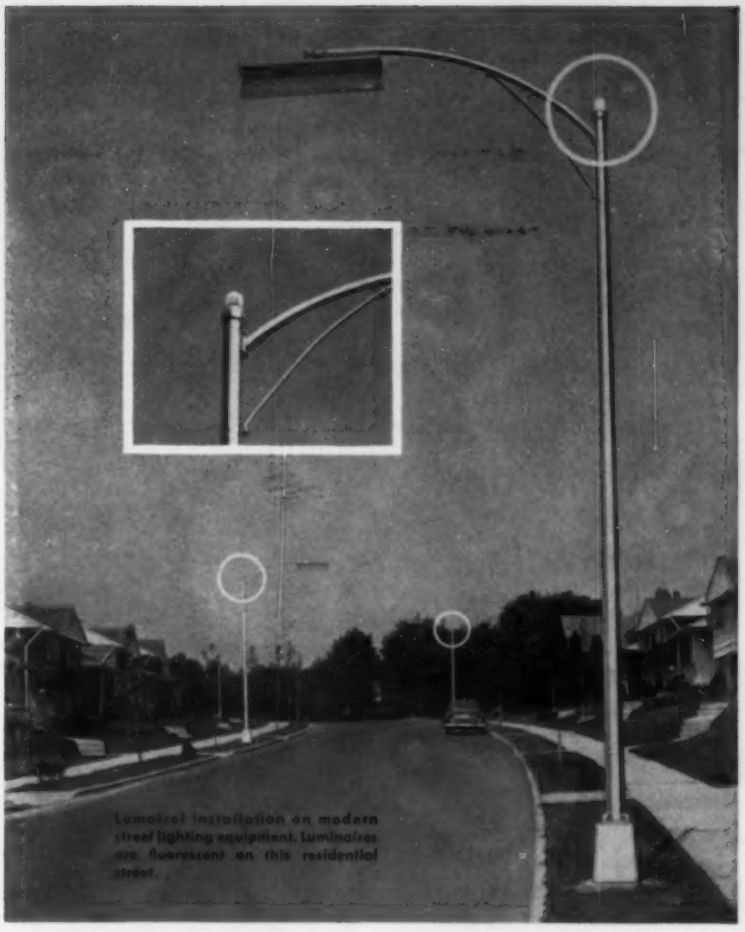
A four-cycle, direct-drive, 3-hp gaso-

line engine powers the generator. Because of its automatic rewind starter and two built-in sockets, manufacturer states that it can be plugged in and be running in seconds. It is available in a dc model (97 lb) or ac (107 lb). **Master Vibrator Co, 262 Stanley Ave, Dayton, Ohio.**

## Scrap Magnet

A lightweight, 45-in. lifting magnet has been designed to speed material handling on scrap yard boom cranes. Weighing 3,200 lb, the magnet is said to be up to 20% lighter than conventional 45-in. sizes, to lift 95% or more of established capacities, and to have a faster discharge time. The improved weight-to-capacity ratio was obtained by using a lighter-type metal for the coil, and by design improvements which allow a more economical use of the coil winding area.

Test records show that, due to the faster maneuverability and more trips per day, an increase of 8 to 10% in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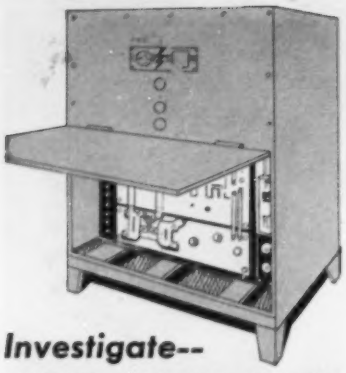

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370 Victoria St., Toronto, Ont.


net tonnage handled can be expected. The test also showed that the boom could be lowered to cover a wider radius without moving the crane.
**Electric Controller & Mfg Co, 2700 East 79th Street, Cleveland 4, Ohio**

## Hoist Support

A "unipod" support for a hoist is available to help in lifting, shifting, or lowering equipment that weighs up to a ton. Useful indoors as well as outdoors, the unipod weighs 22 lb, telescopes to 6 ft 4½ in., and extends in 6-in. steps to 10 ft 2 in. Two 20-ft guy lines are included. They will support more than a ton. Ask for Bulletin 101.
**B. E. Wallace Products Co, Exton 10, Pa.**

## DC Braking Controller

A dc braking controller no larger than a combination linestarter is available in two sizes of enclosures for braking standard induction motors from ¼ to 25 hp. It provides braking torques as much as eight times full load running torque. Operated from a single start-stop pushbutton, the controller's main components include a selenium rectifier, contactors, transformer, and a timing circuit. No adjustment is said to be required after the initial installation.
**Westinghouse Electric Corp, P. O. Box 2099, Pittsburgh 30, Pa.**

## MORE NEW PRODUCTS
**about which you should know**

Chase & Sons, Inc, Randolph, Mass., have a plastic **electrical tape** 0.007-in. thick wtih a dielectric strength of 1,000 v per mil of thickness and a tensile strength of 30 lb per in. of width.

Sorensen & Co, Inc, 375 Fairfield Ave, Stamford, Conn., have first four models of **magnetic voltage regulators** with 15, 30, 60, and 120 va capacities to stabilize line voltage. Ask for catalog MVR1.

Electro-Measurements, Inc, 4312 S. E. Stark St, Portland 15, Ore., has **impedance bridge,** Model 250-DA, for measuring resistance, capacitance, inductance, dissipation and storage factors. 1-kc oscillator and plug-in frequency-selection networks give fixed frequencies between 100 and 10,000 cps.

Industrial Development Laboratories, Inc, 17 Pollock Ave, Jersey City, N. J., has **capacitance bridge,** Model C-10, that indicates with glow lamps degree and direction of unbalance. Measures 10 mmf to 200 mfd.

Homelite Corp, 48 Riverdale Ave, Port Chester, N. Y., has attachment converting its Model 17 **chain saw** into an all-purpose clearing unit. Using the accessory, one man can keep three busy clearing limbs and piling brush.

Instrument Motors, Box 5, Acosta St, Stamford, Conn., has small **high-power motors** in "Frame 43" models. Designed for continuous-duty, Class A service, they have ratings up to ⅛ hp. They are available as either hysteresis or ac induction units.

Revere Corp. of America, Wallingford, Conn., has magnetically operated glass-enclosed, dry-reed **switch** with operating time of one millisecond. Hardly larger than a kitchen match, it works from −85 F to + 500 F at 400 cps. Can carry 10-w lamp load at 115 v ac.

Allen B. DuMont Laboratories, Inc, 750 Bloomfield Ave, Clifton, N. J., has Type 335 **strain gage control** for use with commercial strain gages and

cathod-ray oscillographs having preamplifiers. Company also reveals Type 332 **differential transformer control** for medium audio frequency range. It measures static or dynamic displacements in the region of plus or minus 25 micro-in. to 0.1 in. per major scale division of deflection.

Peerless Photo Products, Inc, Shoreham, L. I., N. Y., has Neoflow **reducing cameras** that make reductions from 2:1 to 6:1 on the continuous-flow principle. Original can be any type up to 42 in. wide, and any length. The copies are negatives.

Mitchell Radiation Products Corp, 128 E. Washington St, Norristown, Pa., has portable unit for complete circumferential **x-ray** of weldments, pipe lines, castings, and boilers. X-TRON 180 penetrates 2⅛-in. steel.

Nord International Corp, 449-41 Central Ave, Orange, N. J., offers foot-operated **speed control** for Di-Profiler machine to help tool-and-die makers.

Micro Switch, Freeport, Ill., has small, light, snap-acting **switch** in an environment-proof construction. Works at −65 F to 180 F, handling 30 v dc, 2.5 amp inductive, 4 amp resistive, with maximum inrush of 15 amp.

Crouse-Hinds Co, Wolf and Seventh North Sts, Syracuse, N. Y., offers an explosion-proof **panel board** with remote controls for vertical fuse cavity drilling machines.

Electronic Rectifier Co, Rochester, N. Y., has three-phase **selenium rectifier** operating on inputs of 220, 440, or 550 v ac, and supplying 100 amp at 230 v dc. May be used with multi-horsepower motors and large lifting magnets.

Dormeyer Industries, Dept. EWN, 3418 N. Milwaukee Ave, Chicago 41, Ill., has compact, rugged **solenoid** using new positioning of double shading coil for high-seated pull. Works in any position on 115 v 60 cps.

Phoenix Precision Instrument Co, 3803-05 N. Fifth St, Philadelphia 40, Pa., has Universal 1000 Series light scattering **photometer** for measuring micro-scattering, micro-fluorescence, micro-luminescence, and low transmittance and reflectance of dark materials.


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The catalog also lists ESCO JR detent-action switches with up to eight selector positions, handling 10 amperes at 125 volts a-c or 5 amperes at 125 volts d-c.

The basic structure of ESCO rotary switches provides for extreme flexibility in design. Tell us your circuit arrangements and the sequences you need, and we will recommend the correct switch for your use.

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Quickly form small-radius bends without flattening or kinking. Especially designed to make neat bends for sharp corners, nooks and other close quarters. Saves up to 75% in time and materials on many jobs.

**KNOCKOUT PUNCHES AND CUTTERS**

For fast, easy enlarging of knockouts and cutting of holes in metal boxes, cabinets, panels. Various sizes and models for making openings for conduit sizes from ½" up to 3½". To operate, simply turn with a wrench.

**HYDRAULIC KNOCKOUT PUNCH DRIVER**

Portable hydraulic unit for driving GREENLEE Knockout Punches. Speeds jobs . . . easily operated. Develops over 11 tons of pressure so that conduit openings are cut in 10-gauge metal with ease.

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Specifically designed to save time, speed jobs . . . eliminate tedious, heavy work. Companion tools to many other GREENLEE timesavers for the electrician.

GREENLEE

Write for new Electrical Tool Folder, Greenlee Tool Co., 1802 Columbia Ave., Rockford, Ill.


# BOOKS

## Background in Sound

*Electroacoustics.* By Frederick V. Hunt. Published by Harvard University Press and John Wiley & Sons, Inc, 440 4th Ave., New York 16, N. Y. 269 pages, illustrated. Price $6.00

This book, No. 5 of the Harvard Monographs in Applied Science, presents the analysis of transduction and its historical background. Basic emphasis is on conversion of sound to electrical energy, as in microphones, and electrical energy to sound, as in loud speakers. But in analyzing electrostatic, electromagnetic and electromechanical systems the author develops a unified approach which is applicable in part to magnetostriction transduction. Engineers concerned with noise generated by transformers and similar electrical equipment could gain background by study of this treatise.

## More About Sound

*Acoustics.* By Leo L. Beranek. Published by McGraw-Hill Book Co, Inc, 330 W 42nd St., New York 36, N. Y. 491 pages, illustrated. Price $9.00.

Much of this book is devoted to developing from physical backgrounds the principles of sound reproduction. Starting with basic wave theory, it progresses through radiation patterns to the design of loud speakers and enclosures to build them into rooms and auditoriums. High fidelity enthusiasts would welcome its treatment of this field.

Utility and equipment design engineers will be more interested in this book for its treatment of sound transmission and noise reduction. It does not go far enough to cover outdoor substations, but the chapters on noise control and acoustic measurements lay the groundwork for more elaborate problems. The book actually developed from instruction given to seniors and graduate students in electrical engineering and should prove valuable in that field.

## Heat Electrically

*Radiant Heating (Second Edition).* By Richard W. Shoemaker. Published by McGraw-Hill Book Co, New York 36, N. Y. 346 pages, illustrated. Price $7.00.

Somewhat technical in content, this book serves best as a text and reference book for contractors, heating engineers and architects. It is neatly broken down in parts, however, for those who merely want to select a suitable type of electric housheating or for those who want a basic discourse on the principles of heating and cooling. There is a section, too, for the individual who desires a detailed explanation of radiant heating and heat pump theory and practice. It is a "how" book enabling an experienced person to design a practical radiant installation to meet any reasonable heating and cooling requirement. With it, Mr. Shoemaker makes a valuable contribution to the growing need for technology in the rapidly-developing field of electric space heating.

# CATALOGS · BULLETINS

● **FRICTION TAPE:** "How Good Is Accurate Tape" is an 8-page report based on experiments conducted by International Testing Laboratories, Inc, in which specifications required by the American Society for Testing Materials were observed. Accurate Mfg Co, 44 Hepworth Place, Garfield, N. J.

● **TIME DELAY RELAYS:** This 12-page bulletin covers adjustable time delay relays for panel mounting as well as fixed and adjustable units for built-in applications. Ask for Bulletin PB-310. R. W. Cramer Co, Inc, Centerbrooks, Conn.

● **CABLE PROTECTOR:** A 5-page leaflet describes the Amp Trap for wire and cable protection. Bulletin CP-6 discusses its time-current characteristics, arcing faults, construction, coordination, and waterproof coatings. Chase-Shawmut Co, Newburyport, Mass.

● **CONNECTORS:** A 27-page Crimpit Bulletin CR-1 describes connectors, accessories, and hydraulic installation tools for overhead distribution applications. Burndy Engineering Co, Inc, Norwalk, Conn.

● **SOLDERING OVEN:** Advantages and specifications for a continuous, automatic soldering oven are decribed in a leaflet entitled "Far-Infrared Soldering Oven." Electrical Industries, 44 Summer Ave, Newark 4, N. J.

● **TACHOMETERS:** Bulletin 770-B gives specifications of stationary and portable "Standco" vibrating reed tachometers. Herman H. Sticht Co, Inc, 27 Park Pl, New York 7, N. Y.

● **LIGHTING HANDBOOK:** Catalog 55 describes application and installation details of fluorescent, slimline, and incandescent fixtures. Data include footcandle standards, fixture spacing, and formulas for computing number of fixtures, lumens, and footcandles. Kayline Co, 2480 E 22nd St, Cleveland 15, Ohio.

● **GLASS BLOCKS:** An 8-page booklet, GB-103, illustrates the use of Suntrol Glass Block for reduction of glare and heat. Pittsburgh Corning Corp, One Gateway Center, Pittsburgh 22, Pa.

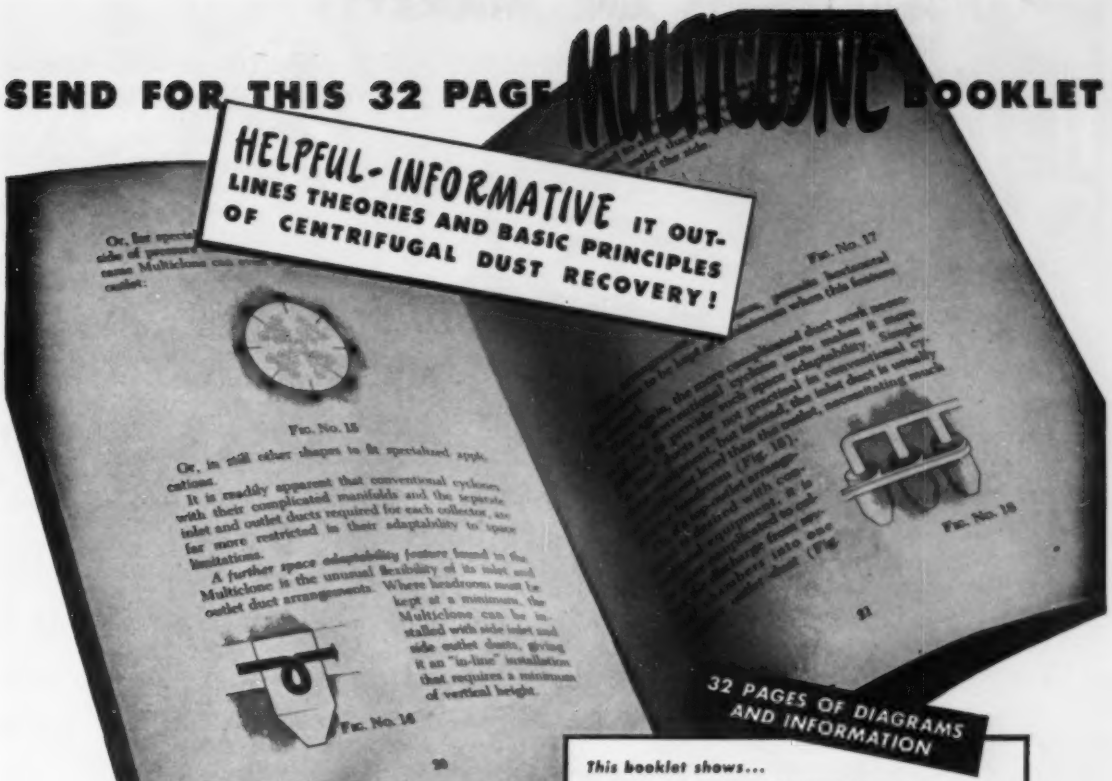
● **MATERIAL HANDLING:** Field Report No. 56 illustrates how an electric utility uses industrial trucks to handle and transport supplies and equipment. Hyster Co, Box 4318, Portland 8, Ore.

● **OVERHEAD CRANES:** Design features and various applications for overhead cranes are illustrated in a booklet (Unit 80) by Whiting Corp, Harvey, Ill.

● **PLASTICS:** Bulletin TSB-1 discusses static electricity and dust control on plastics. Logo, Inc, 13799 South Ave "O," Chicago 33, Ill.

● **VOLTMETERS:** A 4-page bulletin gives base voltages, spans, and accuracies for "D.C. and A.C. Expanded Scale Panel Voltmeters." Arga Div, Beckman Instruments Inc, 220 Pasadena Ave, South Pasadena, Calif.

# SEND FOR THIS 32 PAGE MULTICLONE BOOKLET


HELPFUL-INFORMATIVE IT OUTLINES THEORIES AND BASIC PRINCIPLES OF CENTRIFUGAL DUST RECOVERY!
Fig. No. 15
Or, in still other shapes to fit specialized applications.
It is readily apparent that conventional cyclones with their complicated manifolds and the separate inlet and outlet ducts required for each collector, are far more restricted in their adaptability to space limitations.
A further space adaptability feature found in the Multiclone is the unusual flexibility of its inlet and outlet duct arrangements. Where headroom must be kept at a minimum, the Multiclone can be installed with side inlet and side outlet ducts, giving it an "in-line" installation that requires a minimum of vertical height.
Fig. No. 16
20
Fig. No. 17
Fig. No. 18
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32 PAGES OF DIAGRAMS AND INFORMATION

NO MATTER whether you are now using mechanical dust recovery equipment or are planning the installation of such equipment at some future date, here is a booklet that is full of helpful and valuable information on centrifugal dust recovery. It not only explains the basic methods and principles involved, but also shows the important differences between small and large diameter separating tubes, shows how to simplify your duct work and reduce installation costs, and outlines many other important factors to be considered in selecting mechanical dust recovery equipment.

In addition, this informative booklet illustrates and explains how MULTICLONE'S unique *vane* design is fundamentally different...how it makes possible greater compactness, simpler installation, high recovery of the small particles as well as the medium and coarser ones, and many other facts on MULTICLONE advanced design.

A limited supply of these booklets is available for free distribution to those interested in mechanical recovery equipment and methods. Write for your copy today.

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**MULTICLONE'S SPACE SAVINGS**...How the Multiclone requires less square footage, less cubic footage than most other equipment of comparable capacity and performance, thus saving costly plant space!

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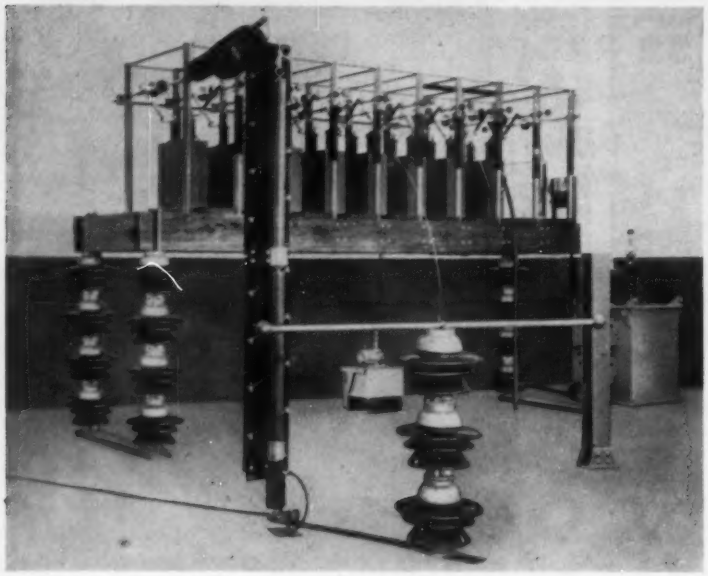

## Victor Installs 800-Kv Impulse Generator

An 800,000-v impulse generator has been installed in the electrical laboratory of Victor Insulators Division, I-T-E Circuit Breaker Co at Victor, N. Y., states Howard Failmezger, vice president. The installation is part of a $150,000 laboratory expansion program.

This test equipment consists of eight 100,000-v capacitors, transformer and rectifier, and control. Latter in a booth includes a Model 293 Dumont oscillograph for showing wave forms, plus a 4 x 5 in. camera for recording these waves on film. The new equipment was constructed by the I-T-E Circuit Breaker Co. in Philadelphia, Pa.

Victor engineers will be able to do research on various insulators, using the standard A.S.A. 1½ x 40 microsecond impulse wave, as well as other wave fronts. They expect to develop more specific data on the effects of lightning on distribution and transmission insulators and thus improve the characteristics of their various insulators.

## Alcaloy Inc Acquires Property in Trenton, N. J.

Alcaloy Inc., associated with Dickey Industries, Cleveland, is planning expansion in Trenton, N. J., according to James W. Dickey, president. Land and buildings in that city have been purchased from Republic Steel Corp. Alcaloy, Inc. was formerly associated with the Round Chain Companies which were recently purchased by Republic Steel Corp.

Alcaloy is an alloy of aluminum and copper, having non-sparking, non-magnetic and corrosion-resistant properties, combined with the hardness of steel. It is used for safety tools and equipment safeguards against fire and explosive hazards. Cost of production of the alloy has been reduced as demand has increased.

## Philco in Los Angeles

Philco Corp has moved its western regional headquarters to 10,589 Santa Monica Boulevard, Los Angeles, Calif., from Beverly Hills. Regional activities relating to microwave communications, industrial field engineering services, and military communications will be centered in the new building. Marshall A. Williams will continue as regional manager.

## Industry on 1955 List of Best Managed Companies

Fifteen manufacturers in an electrical machinery classification have been awarded Certificates of Management Excellence for 1954 in the sixth annual management survey by the American Institution of Management. The companies and subcategories follow:

Listed in more than one subcategory: Electric Auto-Lite Co, Toledo, Ohio; General Electric Company, Schenectady, N. Y.; McGraw Electric Co, Elgin, Ill.; Philco Corp, Philadelphia, Pa.; Robbins & Myers, Inc., Springfield, Ohio; Sprague Electric Co, North Adams, Mass.; Sylvania Electric Products Inc, New York, N. Y.; Westinghouse Electric Corp, Pittsburgh, Pa.; Zenith Radio Corp, Chicago, Ill.

Communication equipment and related products: Motorola, Inc., Chicago, Ill.; Radio Corp of America, New York, N. Y.

Electrical appliances: Sunbeam Corp, Chicago, Ill.

Electrical generating, transmission, distribution and industrial apparatus: Square D Co, Detroit, Mich.

Insulated wire and cable: The Okonite Co, Passaic, N. J.

Miscellaneous electrical products: Electric Storage Battery Co, Philadelphia, Pa.

These companies are among the 379 American and Canadian firms receiving the management citation after a continuing study of the operations of many companies.

Mr. Jackson Martindell, president of AIM, explained that the Institute examines a management in the areas of: economic function, corporate structure, health of earnings, fairness to stockholders, research and development, directorate analysis, fiscal policies, production efficiency, sales vigor, and executive evaluation.

## A-C Acquisition

Allis-Chalmers Mfg Co acquired Feb. 1 Gleaner Harvester Corp (farm equipment) through exchange of common stock on the basis of 3½ shares of Gleaner for one share of Allis-Chalmers.

*Completely New* "SILVER" INSIDE FINISH ON TRIANGLE E.M.T.

Makes Wire Pulling Easier—

and it Protects!

A revolutionary new "Silver" finish on the *inside* of all Triangle E.M.T., makes a hard, smooth, clean raceway—a raceway that makes wire pulling 40% easier by actual tests. This new Triangle finish acts like a lubricant for the wire. No "TACKINESS."

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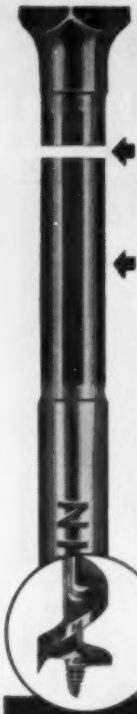

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**"HEX" SHANK**
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Use new Irwin Two-Way "Hex" Shank wood bits in Bit Brace. Remove and use in Electric Drill. **"Hex" Shank fits both — perfectly!** No wobble, no runoff. Speed up work on the job. Reduce replacement stock and handling by 50%. Sizes 4/16" to 17/16". Call your mill supply distributor, or hardware wholesaler for details and prices. Irwin — Wilmington, Ohio.

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## 330-kv Breakers Carry 15 Bushing CTs

As many as 15 bushing-type current transformers are mounted on each 330-kv, three-pole breaker being built by Westinghouse Electric Corp for an AEC plant in Southern Ohio. A total of 35 breakers will be furnished, each having an interrupting rating of 25 million kva. Never before has a three-pole breaker had to carry more than 12 current transformers, nine being more common, stated a spokesman for the manufacturer. Three of the transformers are used for revenue metering. These latter are unusually large to provide adequate cross-section of the case to insure the necessary accuracy. Each transformer is encased in Fosterite and contained in its own aluminum housing which protects it from damage during assembly as well as in service.

## Aluminum Production Is All-Time High in 1954

Primary aluminum production in the United States was 127,056 tons for December 1954, an all-time record on a monthly basis. In addition, this amount is an increase of 5,802 tons or about 4.8% over November, and an increase of 16,765 tons or about 15.2% above December 1953. Total production was 1,460,587 tons for 1954, another all-time record, or about 16.7% above 1,252,014 tons for 1953. The all-time record quarter production was 373,398 tons in the fourth quarter of 1954.

## Penn Transformer Test

Pennsylvania Transformer Co of Canonsburg, Pa., has recently completed the first phase of a half-million-dollar project of installing new transformer test facilities.

The installation consists of a 25,000-kva bank of capacitors installed on the roof of a building adjoining the test floor. This unique installation will enable the company to test transformers larger than 300 Mva and in voltages through 330 kv. The engineering design for this capacitor installation was done by Penn Transformers own engineers, together with those of the capacitor manufacturer, Line Material Co.

At present Penn Transformer is filling a number of orders for transformers in the 330-kv class to be installed on the country's first 330-kv transmission system.

## Reliance and Reeves Approve Merger

Reeves Pulley Co stockholders at a meeting in Columbus, Ohio, on January 26 approved sale of the company to Reliance Electric & Engineering Co, Cleveland. Reliance stockholders approved the merger on January 21.

Combined assets of both companies will exceed $25 million. The merger should increase the total sales of the joint organization which in 1954 was

more than $43 million.

Management at Reeves will remain intact and the organization will continue as a separate division. Reeves has 550 employees and Reliance has over 2,400 people on its payroll.

Reliance is a 50-year old firm manufacturing electric motors and electronically controlled drive systems. Reeves is a well known manufacturer of variable-speed drives.

## MANUFACTURING BRIEFS

**S. Morgan Smith Co** of York, Pa., will pay March 10 a regular quarterly dividend of 25¢ per share, and an extra of 25¢ per share.

**Revere Copper and Brass Inc** has purchased substantially all assets of Standard Rolling Mills, producer and marketer of aluminum foil products. Joseph H. Konigsberg, president of Standard, has been elected a vice president of Revere and will continue to supervise the activities of Revere's new Division. Present personnel of about 500 of Standard will be retained.

**American Institute** of Conductive Glass is a recently formed and incorporated New Jersey organization. Leon Appleman, president of Electriglass Corp of Bergenfield, N. J., was chosen to head the organization. The Institute will undertake the promotion of no-chimney, all-electric, heating and cooking with conductive glass.

**Armour Research Foundation** of Illinois Institute of Technology, Chicago, will construct a $1 million laboratory building. The structure will house the Foundation's electrical engineering facilities and proposed nuclear reactor. Construction is expected to start about March 15 and completion is scheduled for October this year.

**Carborundum Co,** Niagara Falls, N. Y., has established a new unit, the Electro Minerals Division, to manufacture and sell silicon carbide and fused alumina crudes, abrasive grain and related electric furnace products in the United States. Joseph S. Imirie will be general manager of the new division.

## SALES ASSIGNMENTS

### COMPANY STAFFS

**Allen-Bradley Co,** Milwaukee, has made these district office appointments: Charles H. Hawks, formerly in charge of the Flint, Mich., branch of the Detroit office, was appointed district manager of the Pittsburgh office. Hawks succeeds Harry Thornberry, who will open a new sales engineering office in Bridgeport, Conn., under the jurisdiction of the New York office. T. C. Herbes, formerly sales engineer working out of the Detroit office, was named manager of the Flint branch office. Robert L. Gove was assigned to the Detroit office as sales engineer while Harold Mittleman was added to the sales engineering staff of the Cincinnati office. Walter F. Hammer, formerly sales engineer for the Cincinnati office, will take charge of Dayton branch office, operated under the Cincinnati office jurisdiction. J. F. Hoheisel, formerly sales engineer in charge of the Dayton branch office, was transferred to the Cleveland office.

**Jefferson Electric Co,** Bellwood, Ill., has appointed John E. Lee as sales representative for the firm's New England area. Lee, whose headquarters will be in New Haven, Conn., has been with Jefferson since May, 1953.

**Phelps Dodge Copper Products Corp,** New York, has named Albert L. Soule, III, as district sales engineer for the area covering Alabama, west Florida, and east Tennessee, including Knoxville and Chattanooga. Soule, whose headquarters will be in Birmingham, has been with the firm's regional sales office in Atlanta, Ga., since 1952.

**National Electric Products Corp,** Pittsburgh, has selected Harry M. Ryan to manage its newly organized sales district to cover the State of Maryland. Ryan, of Baltimore, has been covering part of the Philadelphia district of the company. He has been a member of the firm's sales force since 1946.

**Day-Brite Lighting, Inc,** St. Louis, has named Joe L. Booker as its Southern sales manager. Booker, formerly district lamp and lighting specialist for General Electric Supply Co, Nashville, will make his headquarters at Nashville, Tenn.

**Worthington Corp,** Harrison, N. J., has designated Roland W. Bartlett, sales engineer, as manager of its Detroit district office. Bartlett goes to Detroit from a succession of advancements, the most recent post being sales engineer in the company's Washington, D. C., district office where he handled government accounts, utilities, and export business.

**Allis-Chalmers Manufacturing Co's** General Machinery Division has named Charles W. Parker, Jr, as manager of the Richmond district. Parker, who has been a representative in that office since 1948, succeeds the late Charles L. Crosby.

**D. W. Onan & Sons, Inc,** Minneapolis, has made Carl Brady sales zone manager for Nebraska, South Dakota and parts of Iowa, Kansas, Missouri, and North Dakota. Brady will be headquartered in Minneapolis.

**Mathias Klein & Sons,** Chicago, Ill., has appointed Jack D. Bruce sales representative for the East Central states.


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## NEWS ABOUT PEOPLE

# Shewmake Elected President

John T. Shewmake, vice president of Southwestern Electric Service Co, has been elected president of the Jacksonville, Tex., utility. He succeeds Carl S. Makeig, president since establishment of the organization in 1945, who has been named chairman of the board.

Shewmake has been active in the utility field for over 30 years. After serving with Stone & Webster, Inc, in Boston, he subsequently worked with utilities in Seattle, Jamaica, B. W. I., El Paso, Galveston, and Lubbock, Tex. Upon his release from the Army Corps of Engineers with the rank of major, he joined Southwestern Electric in 1945. He has been a vice president for the past seven years.

J. T. SHEWMAKE

## Hearn Is Chairman of Ontario Hydro

Dr Richard L. Hearn, general manager and chief engineer of the Hydro-Electric Power Commission of Ontario in Toronto, Ont., since 1947, has been named its chairman. He succeeds the late Robert H. Saunders (EW, Jan. 31, p 39).

A graduate of the University of Toronto, Dr Hearn originally joined Ontario Hydro in 1913 as designing engineer. In 1921 he became affiliated with Washington Water Power Co. Following several engineering appointments with Canadian firms, he returned to Ontario Hydro in 1942 as executive assistant to the chairman.

Actively interested in future possibilities of power from atomic energy, Dr Hearn is a director of Atomic Energy of Canada, Ltd.

DR R. L. HEARN

# Hoffman Made a Vice President of Joslyn

Joseph D. Hoffman has been elected a vice president of Joslyn Manufacturing & Supply Co. He has been president of Hi-Voltage Equipment Co, Cleveland, which became a division of Joslyn beginning Jan. 1.

The new vice president graduated from the University of Missouri in 1925 with a BS degree in electrical engineering. After spending two years with Southwestern Bell Telephone Co as plant engineer, he went to James R. Kearney Corp in St. Louis. He stayed with that company for 25 years, becoming vice president and chief engineer.

Hoffman became associated with Hi-Voltage Equipment in 1953 as that firm's executive vice-president.

J. D. HOFFMAN

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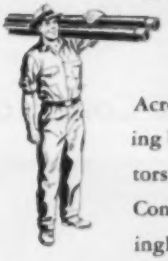

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## Johnson Appointed to Operations Post

Chattanooga (Tenn.) Electric Power Board has announced the appointment of Clarence B. Johnson, general service engineer, to the post of superintendent of operations. Johnson (left) is shown getting a few engineering pointers from E. C. Williamson, who has retired after 44 years' service.

Superintendent Johnson, however, will continue to supervise also the duties of general service engineer until further notice.

## Coughlan Named PG&E Comptroller

New comptroller of Pacific Gas & Electric Co is L. W. Coughlan. He succeeds E. W. Hodges, who has retired after filling the post for 27 years.

Coughlan has been with Pacific G&E since 1916 when he began his career as a clerk in the company office at Nevada City, Calif. He has served in various auditing and accounting posts in Marysville, Auburn, Sacramento, Fresno, and Eureka. He was chief clerk in the San Francisco general office auditing department for 11 years and chief auditor for three years. Last year he was made assistant comptroller.

Hodges joined the company's auditing department in 1917, became general auditor in 1921, and comptroller in 1927.

L. W. COUGHLAN

## Pitzer Heads Oklahoma Group

H. W. PITZER

The newly elected president of the Oklahoma Utilities Association is Harry W. Pitzer, vice president of Public Service Co of Oklahoma. Pitzer, a former vice president of the association, succeeds Earl J. Newlin, president of State Fuel Supply Co.

The association's other new officers include: First vice president, H. C. Webb, Oklahoma Natural Gas Co; second vice president, H. P. Hoheisel, Oklahoma Gas & Electric Co; and treasurer, H. H. Ferrin, Oklahoma G&E.

## OBITUARY

**H. W. Zimmer,** 57, president of Sylvania Electric Products Co, Inc, died Jan. 28 in New York City. He was employed by Sylvania and predecessor companies since 1919, and was still a resident of Emporium, Pa., where he joined the firm.

**Jerald P. Moore,** 61, Cleveland District manager of The Electric Controller & Mfg. Co., died on Jan. 13. Moore, a 1916 graduate of Cleveland's Case Institute of Technology, joined EC&M in 1923.

**Edwin C. Minteer,** executive director, assistant secretary, and assistant treasurer of the Electrical Equipment Representatives Association, died recently.

## MEETINGS CALENDAR

### Week of Feb. 6-12

**EDISON ELECTRIC INSTITUTE**
Accident Prevention Committee, Shoreham Hotel, Washington, D. C., Feb. 9-10; Transmission and Distribution Committee, Shoreham Hotel, Washington, D. C., Feb. 10-11.

**PENNSYLVANIA ELECTRIC ASSOCIATION**
Winter Meeting, Transmission and Distribution Committee, Hotel Roosevelt, Pittsburgh, Feb. 10-11.

**INSTITUTE OF RADIO ENGINEERS**
7th Annual Southwestern Conference and Electronics Show, Baker Hotel, Dallas, Tex., Feb. 10-12.

## Meetings Calendar

(*Continued from page* 144)

### Week of Feb. 13-19

**NATIONAL ASSOCIATION OF PURCHASING AGENTS**
24th Annual Mid-Winter Conference, Public Utility Buyers' Group, Shamrock Hotel, Houtson, Tex., Feb. 13-15.

**EDISON ELECTRIC INSTITUTE**
Industrial Relations Committee in conjunction with AGA at AMA Mid-Winter Personnel Conference, Palmer House, Chicago, Feb. 14; Electrical Equipment Committee, Deshler Hilton Hotel, Columbus, Ohio, Feb. 14-15; Commercial Electric Space Heating and Air Conditioning Committee, Terrace Plaza Hotel, Cincinnati, Ohio, Feb. 17-18; Residential Promotion Committee, New York, Feb. 20-21; Accounting Conference, Planning, Edgewater Beach Hotel, Chicago, Feb. 17-18.

**PENNSYLVANIA ELECTRIC ASSOCIATION**
Winter Meeting, Prime Movers Committee, Roosevelt Hotel, Pittsburgh, Feb. 14-15; Winter Meeting, Relay Committee, Hotel Roosevelt, Pittsburgh, Feb. 15-16; Winter Meeting, Electrical Equipment Committee, Benjamin Franklin Hotel, Philadelphia, Feb. 17-18.

**NATIONAL RURAL ELECTRIC COOPERATIVE ASSOCIATION**
Annual Meeting, Convention Hall, Atlantic City, N. J., Feb. 14-17.

### Week of Feb. 20-26

***CALIFORNIA MUNICIPAL UTILITIES ASSOCIATION**
24th Annual Conference, Hotel Senator, Sacramento, Feb. 22-25.

**PACIFIC COAST ELECTRICAL ASSOCIATION**
Conference on Electronic Integrated Data Processing, Hotel Statler, Los Angeles, Feb. 23-24.

**NATIONAL ADEQUATE WIRING BUREAU**
11th Annual Conference, La Salle Hotel, Chicago, Feb. 24-25.

**PENNSYLVANIA ELECTRIC ASSOCIATION**
Systems Operation Committee, Abraham Lincoln Hotel, Reading, Pa., Feb. 24-25.

### *Week of Feb. 27-March 5

**SOUTHERN SAFETY CONFERENCE-EXPOSITION**
Jung Hotel, New Orleans, La., Feb. 27-March 1.

**AMERICAN SOCIETY OF MECHANICAL ENGINEERS**
1st International Congress on Air Pollution, Hotel Statler, New York, March 1-2.

**EDISON ELECTRIC INSTITUTE**
1st Street Tree and Utility Conference, co-sponsored by EEI Transmission and Distribution Committee, Street Lighting Committee of Illuminating Engineering Society and National Shade Tree Conference, Wade Park Manor, Cleveland, March 3-4.

*Additions this week.

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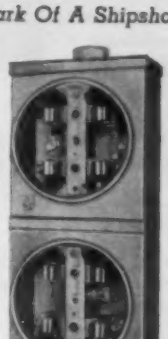

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## Wood vs Steel

(*Continued from page 68*)

No concrete encasement is used except where the underground water table is high or towers are in truck gardens. Probable remaining life of the towers is difficult to estimate.

The 44-kv loop line built between 1906 and 1910, using untreated cedar poles, was stubbed before 1927. A program of replacing poles, arms, braces, and insulators was started in 1936 and carried into 1946. The new poles are cedar, butt-treated with creosote. Two 115-kv, H-frame lines were built in 1930 of Southern yellow pine poles with full-length creosote treatment. These show no sign of deterioration. Wood arms for these lines are Douglas fir. It is important to note that checking practically is eliminated when the arms are treated with pentachlorophenol in oil and stored properly for seasoning.

There is mounting evidence that poles, arms, and other wood components should be full-length treated to make the life of all parts of the structures uniform. Poles in two 44-kv lines show considerable evidence of rot above the butt treatment. Untreated crossarms, wood arm braces, and wood guy strains also are showing signs of decay in their early years. Practically no termite damage has been encountered.

**One-Circuit H-Frames Cost Less . . .** Construction costs of 115-kv wood H-frame (Fig 8) is less than that of steel towers (Fig 7). When the cost of right-of-way exceeds $4,000 per mile per line, however, the cost of one double-circuit tower line (Fig 6) is less than two lines of H-frame wood poles.

Some property owners claim wood poles are less conspicuous than steel towers and take up less usable ground surface. This attitude may affect the cost of right-of-way. The higher-voltage lines require steel because of the size of structures and conductors.

Wood arms and poles are subject to burning caused by 60-cps leakage current, but proper bonding of arms and braces can eliminate this. Some splintering under lightning strokes will be encountered if proper designs are not used. Wood poles are better for snow slide conditions in the mountains.

Unbonded wood arms, where they can be tolerated, are helpful in solving bird problems. Operation and maintenance costs per mile of line seem to be about the same for steel and modern wood designs.

## Holtwood River Coal Unit

(*Continued from page 77*)

quence and transformer neutral relays operates a time delay auxiliary to trip OCB's beyond the generator breakers.

**Auxiliary Electrical Equipment . . .** Normal supply for the station auxiliaries is from a 10,000-kva, 13,200/4,160-v transformer connected to the generator leads. Standby and start up supply is from a 7,500/9,375-kva OA/FA transformer connected to the 13-kv hydro station bus. The 4,160-v side of both transformers is "Y" connected and grounded through potential transformers for phase-to-ground indication. The 4-kv voltage for the system was chosen over the 2.4 kv because of a higher margin of short circuit duty permitted in the breakers, simplicity in one-line diagram, and reliability in operation. Estimated cost of the two systems was approximately equal.

The 4,160-v switchgear is of the metal-clad type and consists of a single-bus arrangement with a dummy removal element in the center so buses can be sectionalized in case of bus failure. The two incoming breakers are interlocked so that they cannot both be closed at the same time, except momentarily when transferring from one source to another. Station service, normally supplied from the step-down transformer on the generator leads, is automatically transferred to the continuously energized starting source by an undervoltage relay. The normal source ACB trips at reduced voltage, but transfer to the starting source is not completed until motor contribution has dropped to 25% normal voltage, elapsed time being about 60 cycles.

The 480-v system consists of two separate bus sections with essential services split between the sections. Each bus section is fed by a 1,250-kva, 4,160/480-v dry-type transformer connected to the 4-kv system. Connected between the two bus sections is a 1,000-kva, 4,160/480-v dry-type transformer. It serves as a spare for either of the two 1,250-kva transformers or for use as back-up for the old station. The spare transformer is connected to either bus section by a breaker and is so interlocked that the breaker cannot close unless the transformer breaker, normally supplying the bus section, is open. All breakers are of the draw-out type.

The 4,160-v and 480-v switchgears are located in the same room without a barrier wall. Outside air supplied to the room for ventilation is filtered to protect the dry-type transformers from station coal dust and dirt.

Motor control centers are used for the control of smaller motors. They are located as near the center of load as possible. In most cases the motors are visible from the control centers.

Station auxiliary motors over 200 hp are supplied at 4,160 v, and smaller motors are supplied at 480 v. In general, indoor motors are drip-proof. Large outdoor motors are weatherproof, base-ventilated, and those 50 hp and below are totally enclosed.

A public address system, operated on 120-v a-c with emergency automatic thrower to an Mg set powered from the 250-v control battery, is provided for communication in the operation of the unit.

Emergency lighting is normally on for the new extension and is supplied by a 230-v dc source from the hydro station bus. There is no transfer from ac to dc when ac fails, except in the control room.

Ebasco Services, Inc of New York, as agents for Pennsylvania Water & Power Co, carried out the design and construction of the Steam plant addition.

## Offers New Dishwasher

Frigidaire Division of General Motors makes its entry into the automatic dishwasher business with a unit that whirls jets of hot water directly onto the pieces being washed. It works with a whirling horizontal spray tube which turns at a rate of 500 rpm and delivers the water jets at a pressure of four psi. Company expects dishwasher sales for industry to hit $68 million this year and $89 million in 1958 (compared to estimated $57 million in 1954).

## Lower Tariffs Scored

(*Continued from page 56*)

by buying at a lower price from foreign manufacturers.

To the argument that the U. S. must lower its tariffs to help the economy of friendly nations, and thereby strengthen their defenses, Price pointed out that in the past two years foreign nations had earned $4 billion more than they spent. "Europe had a booming economy in 1954, while we went through a slight recession," he added.

Price said that apparently few people realized how low U. S. tariffs have been cut and the extent of foreign restrictions on shipment of American products. "It is not possible to sell U. S. electrical power equipment in Germany, England, or Switzerland," he said.

W. C. Carpenter, vice president, R. Thomas & Sons Co, a leading manufacturer of porcelain insulators and line hardware, urged that trade barriers be strengthened rather than weakened. Carpenter mentioned competition from Japan specifically. He noted that a recent order for 44 carloads of insulators for Bonneville Power Administration's 330-kv line had been awarded to Japan.

"With a plant capacity of a carload per day, Lisbon, Ohio, alone was denied 8,800 days work which our own government blithely exported to Japan."

Because of standardization in the insulator industry here, the foreign competitor "can copy and duplicate our insulators to the last detail, and does so, all without the expense of research and development, all without promotional costs and with access to the same modern equipment available to us for manufacture. Sometimes we feel that our government itself is bending backward to act as a sponsor or an angel to strengthen this parasitic situation," Carpenter said.

## Delaware P&L Adds Unit

Generating capacity at the Edge Moor Power Station has been increased by almost 60% now that a 78,000-kw generating unit has been placed in regular service by Delaware Power & Light Co.


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## Feather Project...

### . . . gets endorsement from California governor as he asks legislature to act on financing

Gov Goodwin J. Knight set the stage for action on California's pressing water and power problems by urging the legislature to take immediate steps to determine the most effective way of financing and constructing the $1.2-billion Feather River project.

**Backs Trinity Project . . .** The governor also recommended construction of the Trinity River project, planned by the Bureau of Reclamation, as well as the San Luis project on the west side of the San Joaquin Valley.

State Engineer A. D. Edmonston will have a report ready March 1 on the Feather River project, which will contain a step-by-step construction program, a schedule of deliveries, an estimate of funds required for construction, and suggested means of financing. Knight asked the legislature to act expeditiously once the report is presented "so that right-of-way acquisition can begin without delay and that initial phases of construction may be under way by this time a year hence."

The governor asked the legislature to approve a joint resolution urging Congress to begin consideration of the Trinity River project, including all its power facilities, at the earliest possible date. The state already has informed the Secretary of Interior that the project is feasible from an economic and engineering standpoint. The San Luis project, Knight said, could utilize surplus water obtained from either the Trinity or Feather River projects, and should be included in whichever is finished first.

**Opposes State Purchase of CVP . . .** Knight set back the hopes of those favoring state purchase of the Bureau of Reclamation's Central Valley Project. He said flatly that he opposes state purchase "at this time," and added:

"The United States government has indicated that it has no interest in selling the project. We have greater and more immediate needs for the construction of the Feather River project, the Trinity River project. . . ."

## KU Breaks Ground for New Steam Plant

E. W. Brown, vice president of Kentucky Utilities Co, turned over the first spadeful of earth late last month for a 500,000-kw generating plant which will bear his name. The plant will be built at Dix Dam, Ky., with the first 125,000-kw unit scheduled to begin operation in 1956. Cost of the unit is estimated at about $16,345,000.

Pictured with Brown at the ground-breaking ceremonies are (l to r) Harry Reid, Kentucky Utilities first vice president; R. M. Watt, KU president, and Judge Robert M. Coleman (behind Watt), chairman of Kentucky Public Service Commission.

Judge Coleman told the more than 300 local and state officials, industry leaders and company officials present that he was proud of the utilities of the state and placed KU among the top in "the great service they are giving at a reasonable cost."

"If nobody gave the commission any more trouble than KU," he said, "our job would be a great joy."

KU President Watt explained that the chief reason for the new plant was that Kentucky is rapidly becoming an industrial state and the electricity from the new plant will be needed to power the state's industrial growth and attendant growth in the commercial, residential, and rural fields.

## Brazil Starts New Plant

Brazil started operations last month at a big hydroelectric power plant at Paulo Affonso Falls on the Sao Francisco River. The $24.4-million development, aimed at stimulating growth of Brazil's backward Northeast, will provide power for a vast eight-state area in which a fifth of all the country's population lives. The three-part project includes a four-mile long V-shaped dam, a power station and transmission lines to Bahia. The plant, whose initial capacity is 120,000 kw, houses a 83,000 hp vertical turbine directly linked to two 60,000-kw generators. Another 60,000-kw generator is expected to be functioning soon. Further expansion of the plant is scheduled in order to bring total capacity to 540,000 kw.

## Colorado Utility Defends Right to Serve Project

Public Service Co of Colorado, in reply to charges made by a rural electric cooperative, declared in Brighton, Colo., district court that it has the "obligation, duty and right" to provide service to a 6,000 home project on outskirts of Denver.

Union Rural Electric Association of Brighton filed suit last November seeking an injunction to stop the public utility from going ahead with plans to supply electric service to the housing development. The co-op has claimed it had an agreement with Public Service defining their respective service territories north of Denver.

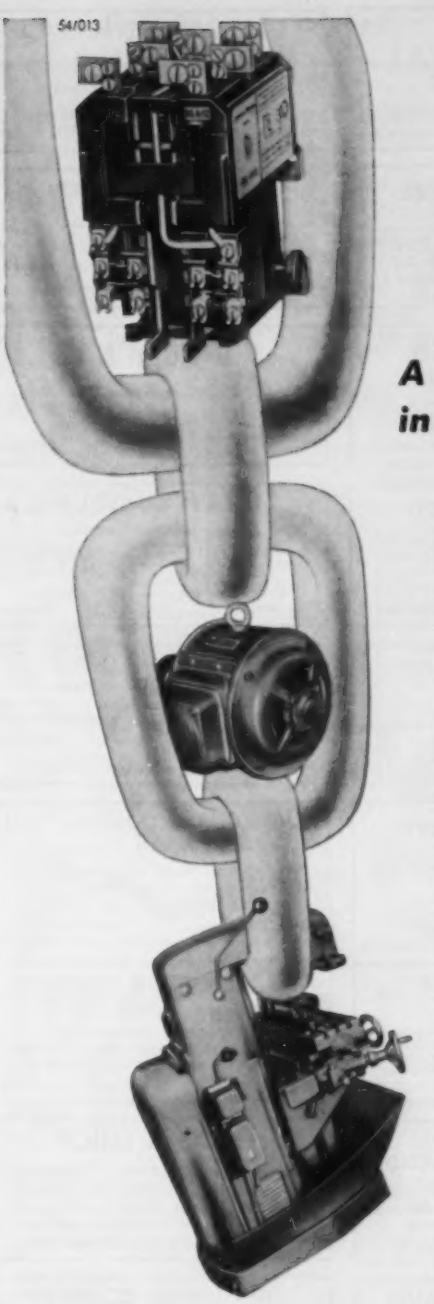
Answers filed in court by Public Service and signed by W. W. Howell, assistant treasurer for Public Service, declared "no agreement" exists. They also said the "record discloses no written or oral correspondence or instruction" and "no maps were agreed upon as representing the results of a 1945 conference" between the private utility and co-op officials.

Union REA contended that Public Service plans to serve the project were an "invasion" of its territory.

A hearing on the issue has been scheduled Feb. 14 in Brighton. District judge said he would hear arguments on two motions by Public Service to dismiss the co-op's suit. Public Service charges in those motions that the court "lacks jurisdiction over the subject matter" and that Union REA has "failed to exhaust administrative remedies."

## Pushes Promotion Plans

Plans for an aggressive program of trade promotion for all segments of the electrical industry have been announced by the Snake River Valley Electrical Association, Inc, Boise, Idaho. Besides appliance promotion programs, the association contemplates these projects: Adequate wiring, electrical trade shows and expositions, and strengthening state electrical law with adoption of the new National Electrical Code on a statewide basis. Association's membership includes distributors, manufacturing representatives, contractors, retail dealers, and utilities in electrical and electronics fields in southern Idaho and eastern Oregon areas.

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P-5364, Electrical World
330 W. 42 St., New York 36, N. Y.



ADDITIONAL EMPLOYMENT ADVERTISING ON PAGE 152


# Advertising in This Issue


Allen-Bradley Co. ..... 19, 20
Allis-Chalmers Mfg. Co. ..... 4th cover
16, 17, 30, 46, 47 97
American Blower Corp. ..... 40, 41
Anaconda Wire & Cable Co. ..... 49
Anchor Mfg. Co. ..... 145
Ansul Chemical Co. ..... 18

Bartlett Tree Experts ..... 8
Bell Telephone Laboratories ..... 31
Bethlehem Steel Co. ..... 11
Brown Co. ..... 117
Bussmann Mfg. Co. ..... 22, 23

Chance Co., A. B. ..... 124
Cool-Amp Co. ..... 147

Delta-Star Electric Div., H. K. Porter Co., Inc. ..... 95
Directory of Engineers ..... 150
Dow Chemical Co. ..... 123
Driver-Harris Co. ..... 125
du Pont de Nemours & Co. (Inc.), E. I. Grasselli Chemicals Dept. 6

Electric Storage Battery Co. .3rd cover
Electro Switch Corp. ..... 135
Engineers Directory of ..... 150
Everstick Anchor Co. ..... 116

Foushee & Heckendorn ..... 132

G&W Electric Specialty Co. ..... 115
General Electric Co.
Apparatus Dept. ..... 86, 87, 88, 89
90, 92, 93, 155
Electronics Dept. ..... 9
Graybar Electric Co. ..... 5
Greenlee Tool Co. ..... 136
Grinnell Co., Inc. ..... 7
Grip-Tite Mfg. Co. ..... 147

Hazard Insulated Wire Works ..... 4
Holan Corp., J. H. ..... 37
Hubbard & Co. ..... 121

I-T-E Circuit Breaker Co., R&IE Equipment Div. ..... 35
Indiana Steel & Wire Co. ..... 141
International Harvester Co. ..... 44
Irwin Auger Bit Co. ..... 140

Kearney Corp., James R. ..... 48
Keasbey & Mattison Co. ..... 34
Kerite Co., The ..... 52
Klockner-Moeller ..... 149
Kuhlman Electric Co. ..... 32, 33

Leeds & Northrup Co. ..... 161
Locke Dept. General Electric Co. ..... 36

McCabe-Powers Auto Body Co. ..... 25
Meter Devices Co. ..... 140
Micro Balancing Inc. ..... 133
Mineralac Electric Co. ..... 132
Minneapolis-Honeywell Regulator Co., Industrial Div. ..... 126, 127
Moloney Electric Co. ..... 50, 51

Nuclear Development Assoc., Inc. 159

Okonite Co., The ..... 4
Orangeburg Mfg. Co., Inc. ..... 143

Page Fence Ass'n ..... 132
Page Steel & Wire Div. American Chain & Cable ..... 100
Pennsylvania Transformer Co. ..... 42, 43
Pfaff & Kendall ..... 14
Porcelain Insulator Corp. ..... 26
Porcelain Products, Inc. ..... 122
Preformed Line Products Co. ..... 21
Premax Products Div. Chisholm-Ryder Co., Inc. ..... 147

Richardson-Allen Corp. ..... 134
Rockbestos Products Corp. ..... 157
Ronald Press Co., The ..... 141
Royal Electric Mfg. Co. ..... 131
Ryerson & Son, Inc., Joseph T. ..... 145

Searchlight Section ..... 151, 152, 153
Shell Oil Co. ..... 98
Sierra Electronic Corp. ..... 113
Simplex Wire & Cable Co. ..... 128
Socony-Vacuum Oil Co., Inc. ..... 15
Sorgel Electric Co. ..... 24
Southern States Equipment Corp. .. 10
Square D Co. ..... 45
Standard Transformer Co., The. 12, 13

Texas Co., The ..... 2nd cover
Thomas & Betts Co., The ..... 164
Thompson Chemicals Corp. ..... 130
Triangle Conduit & Cable Co., Inc. 139

United States Rubber Co. ..28, 38, 39
Uptegraff Mfg. Co., R. E. ..... 29

Western Precipitation Corp. ..... 137
Westinghouse Electric Corp. ..101, 102
103, 104, 105, 106, 107, 108
109, 110, 111, 112
Wheeler Reflector Co. ..... 27


■


PROFESSIONAL SERVICES ..... 150


■

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EMPLOYMENT
Positions Vacant ..... 151, 152
Selling Opportunities Offered ..... 152
Positions Wanted ..... 152
Selling Opportunities Wanted ..... 152
Employment Services ..... 152

EDUCATIONAL
Periodicals ..... 152

NOTICES
Proposal ..... 152

EQUIPMENT
(Used or Surplus New)
For Sale ..... 153

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DISTRIBUTION ENGINEERS — Graduate Electrical Engineers — Senior — at least 10 years field experience with operating utility company. Junior 3 years experience. Permanent position long established consulting organization New York. Some travel Latin America necessary in future. Knowledge of Spanish or Portuguese useful. Salary commensurate with experience. Reply stating age, education, experience, personal particulars and minimum salary expected. P-5277, Electrical World.

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**RA-5293,** Electrical World
330 W. 42 St., New York 36, N. Y.

### U. S. Government

DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation No. DS-4336), will be received at Denver, Colorado, until March 10, 1955, for furnishing one 8,000/10,000-kva, 110,000- to 41,800-volt, 3-phase, class OA/FA, outdoor power transformer for Fargo Substation, North Dakota, Missouri River Basin Project. Delivery is desired within 300 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver 2, Colorado. W. A. Dexheimer, Commissioner.

Sealed bids will be received in the office of Engineering and Construction Director, Panama Canal Company, Balboa Heights, Canal Zone, until 10:00 A.M., EST, March 11, 1955 for furnishing all labor, equipment, material and performing all work required for alteration of Gatun Hydro-electric Station and outdoor switchyard; conversion of station service, penstock headgate, spillway equipment from 25 to 60 cycle; construction of a new control room; purchase and installation of new transformers, metal clad switchgear and associated bus duct. Plans and specifications are available for examination in the office of Procurement Officer, Panama Canal Company, 21 West St., New York 6, N. Y., and copies may be obtained upon payment of $40.00 deposit. For further information call Bowling Green 9-5380.

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| 75 | G.E. | RCP-34 | 1750 |
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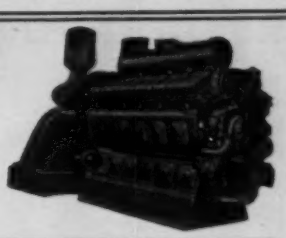

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| 1136 | Fairbanks Morse | 38D | 1600 | 720 | 300 | General Motors | 8-268A | 450 | 1200 |
| 1100 | General Motors | 16-278A | 1600 | 720 | 250 | Clark | GD-4 | 375 | 360 |
| 750 | General Motors | 12-567 | 1080 | 720 | 200 | General Motors | 8-268A | 350 | 900 |
| 700 | Worthington | EE-6 | 1000 | 327 | 175 | General Motors | 12-71 | 275 | 1800 |
| 600 | General Motors | 12-567 | 800 | 600 | 150 | Worthington | CC-4 | 235 | 450 |
| 500 | General Motors | 8-567 | 720 | 720 | 100 | Buskeye | 180 | 240 | 600 |
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| 340 | Baldwin | VO-6 | 510 | 450 | 100 | General Motors | 3-268A | 180 | 1200 |
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3—1000 KVA Mol. 13200-2400/4160Y
3—1000 KVA Mol. 11500-2400/4160Y
3— 833 KVA G-E 35000—480
3— 500 KVA G-E 28400-240/480
3— 333 KVA W-H 13200-7200/12470Y
3— 333 KVA G-E 33000-2300/4000Y/6900/-11950Y
3— 333 KVA G-E 33000-2300/4000Y
3— 333 KVA Mol. 7200/12470Y-2300/4160Y
3— 200 KVA W-H 13200-230/460
3— 150 KVA G-E 19050/33000Y-2540/4000Y
5— 150 KVA G-E 7200/12470Y-240/480
3— 100 KVA G-E 33000-6900/11950Y

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| QU. | KVA | MFR. | VOLTAGE |
|---|---|---|---|
| 1 | 5000 | West. | 115000—14400, 3 ph. |
| 1 | 10000 | A. C. | 66000—33000, 3 ph. |
| 1 | 3750 | West. | 66000—14400, 3 ph. |
| 4 | 2500 | Mol. | 66000—13800 |
| 3 | 800 | Kuhl. | 66000—480 |
| 4 | 500 | West. | 69000—6900 |
| 1 | 400 | G. E. | 66000/33000—2300/4160 |
| 3 | 333 | Stand. | 69000/34500—7300/12470 Y |
| 3 | 200 | Pitts. | 66000—2300 |
| 3 | 1500 | Wag. | 44000—6900 |
| 3 | 1250 | A. C. | 44000/11500—460 |
| 4 | 150 | West. | 44000/33000—2300/6900 |
| 3 | 75 | West. | 44000—7200/12470 Y |
| 3 | 5000 | G. E. | 38100/66000—6600 |
| 1 | 3750 | Penna. | 38030/65865 Y—13800, 3 ph. |
| 3 | 3333 | G. E. | 38100/66000 Y—33000 |
| 4 | 3125 | Mol. | 39900/66000 Y—22600/38000 Y |
| 6 | 2000 | Mol. | 38100/66000 Y—13800 |
| 3 | 3333 | G. E. | 39000/11900—2400/7200 |
| 4 | 333 | G. E. | 34500—13800/23000 Y |
| 1 | 3000 | G. E. | 330—6900/2300, 3 ph. |
| 2 | 3000 | Stand. | 33000—4160, 3 ph. |
| 3 | 200 | A. C. | 34500—2400/7200/12470 Y |
| 3 | 75 | Wag. | 33000—240/480 |
| 1 | 1250 | G. E. | 26400/13200—2400 |
| 4 | 1500 | A. C. | 25400/44000 Y—4950/13800 |
| 4 | 450 | A. C. | 25410/44000 Y—13250/23000 |
| 3 | 100 | G. E. | 22000—7200/12470 Y |
| 3 | 667 | A. C. | 19053/33000 Y—2400/4160 Y |
| 1 | 2000 | G. E. | 13800—2300, 3 ph. |
| 1 | 600 | Stand. | 13200—2300, 3 ph. |
| 1 | 450 | Penna. | 13200—3400, 3 ph. ASKAREL |
| 6 | 200 | G. E. | 13200—230/460 |
| 4 | 167 | G. E. | 7200/12470 Y—2400 |
| 3 | 125 | A. C. | 6900—2300 |
| 3 | 37½ | G. E. | 6900—230/460 |
| 6 | 150 | G. E. | 4800/2400—240/120 |
| 2 | 100 | G. E. | 4800/2400—240/480 |
| 1 | 1500 | G. E. | 4160—480, 3 ph. |
| 3 | 333 | G. E. | 2400/4160 Y—460 |
| 3 | 250 | G. E. | 2300/4000 Y—115/230 |
| 3 | 200 | West. | 2400—240/480 |
| 1 | 150 | West. | 2400—230/115 |
| 1 | 100 | G. E. | 2300—575, 3 ph. |

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C. F. NAGLE

**Above is the picture of C. F. Nagle, president, Scranton Electric Co. Recently the company was granted a rate increase. With the story (EW, Jan. 3, p63) . . .**

C. F. NAGEL, JR

**. . . this picture (above) was run. But this is the picture of C. F. Nagel, Jr, who is a vice president of the Aluminum Co of America with offices at Pittsburgh . . .**

C. F. NAGEL, JR

**. . . Both men were quick to point out the error. To set the record straight, they sent pictures. The one above is that of C. F. Nagel, Jr, (Alcoa) as he looks today.**

# Controlled Water Heating Looks Permanent

To the Editor:

Your editorial, "Control of Residential Loads," (Nov. 1, 1954, p 361 was a service to the industry because the needling at the general principle of controlling loads makes us think and because it points out a serious fault in our communication of the reason for such control. When the editorial staff of a leading trade journal in the field believes that the reason for control of water heating load had or has for its basis any fears of ability to serve the load, the electric utility industry certainly has failed in its communications.

Back in the '20's very few electric water heaters were being manufactured. Those that were in use were enjoyed by the users. They gave satisfactory service even though the price was high. But the cost to the utility of furnishing electricity for water heating under the uncontrolled condition was (and still is) roughly double the cost of furnishing storage-type controlled service—consequently the difference in rates to the public.

To the best of my knowledge we were never afraid of our ability to furnish uncontrolled water heating service. As you stated, water heating was a large market for electricity. We wanted to develop and serve that market. But the public was unwilling to pay a price which would be somewhere near equal the cost. The value of that service to the great majority was considerably less than the cost to the utility and the price to the public.

So, if we were to reach that market, it was obvious that we had to find a way to bring down the cost, and thus the selling price, to a point about equal to the value of the service to most people. The storage-type off-peak heater was the answer, requiring about 100 w of system peak capacity (diversified demand of the uncontrolled upper unit), as against about 800 w (fully diversified on-peak demand) of system peak capacity for uncontrolled operation.

In our widespread system, power at the distribution substation costs about $57 per kw-year of system demand, for power system capacity costs, plus about 35/100ths cent per kwhr for energy costs. A half kilowatt of system capacity per customer costs about $30 a year.

Our results to date are an electric water heater saturation of about 31% in areas not having natural gas and about 24% in areas where natural gas is available. Rural saturation is 34%.

I agree with the quoted observation of Mr. Snow that for uncontrolled water heaters it makes little difference at the power house whether high-wattage or low-wattage heaters are used. If controlled, it does make some difference in that wattage will have an effect at the beginning of each off-peak period and upon the on-peak demand of the upper unit. It will also have a large effect upon how much of the energy requirement will be generated during the period midnight to 6 AM as compared with other periods. Unit wattage also has an effect on local distribution costs, and with high saturations this should not be overlooked.

Is there a belief that most customers would prefer to take uncontrolled water heating service and pay its fair cost as compared with the less expensive controlled service? We have had uncontrolled service available at the regular rate applicable to general residential service, but only a

# NEXT: GASEOUS INSULATION

An entirely new concept—*gas* as a power transformer insulation and coolant—is now being used by General Electric engineers at Pittsfield, Mass. The gas is sulphur hexafluoride chosen because of its high dielectric strength.

Lighter, quieter, safer . . . these are the predictions for this revolutionary design, a joint project of G.E. and the Consolidated Edison Company of New York. Above is a model of the 2000-kva, 69-kv units now being built.

Gas-insulated transformers will be *safer* because sulphur hexafluoride is non-flammable; *quieter*—because pressurized gas conducts sound far less readily than liquid; *lighter and more compact*—because the gas will eliminate heavy liquid insulation. General Electric Company, Schenectady 5, N.Y.

423-27

**Power Transformer NEWS**

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**GENERAL ELECTRIC**

few customers take it. My view is that because of the fundamental economics involved and the improbability that the habit of most people to sleep at night will change, controlled electric water heating will be with us for a long time.

Glydewell Burdick
Manager, Rate and Valuation Dept
Wisconsin Power & Light Co
122 W. Washington Ave
Madison 1, Wis.

## Eugene, Ore., Installs Demand Meters

To the Editor:

In the "Readers Forum" of Nov. 15 (p 206) there appeared opposite opinions concerning electric demand meters. The Eugene Water & Electric Board is beginning the installation of a large number of demand meters. These are installed for residential use where the customer qualifies for our "all electric" rate. This rate will apply to electric heat customers provided the residence has adequate ceiling insulation, that heating elements are limited to a maximum size of 3 kw each, and that each heating element is thermostatically controlled. The demand charge for this service is 30¢ per kilowatt.

The average cost of converting the customer's conventional meter is estimated to be $50. We believe that the demand charge will stimulate the customer's interest in controlling his demand. We also believe that in so doing he will not reduce his total energy consumption.

On the other hand, each kilowatt of reduction of the customer's peak will represent, in our case, a savings of an investment of approximately $300 (at current prices) in hydro generation by either the board or the federal government, not to mention a reduction or delay of investment in distribution facilities. In view of the present and expected continuing growth in the demand for electric energy, I do not see how any utility can long escape a proper use of a demand charge. We purchase from the Bonneville system on exactly that basis. We wish to give the customer "what he wants," but we believe that he should pay for it.

R. B. Boals
General Supt-Sec'y

Eugene Water & Electric Board
500 East 4th Avenue
Eugene, Ore.

## 400-Amp House, a Salesman's Dream

To the Editor:

"Tomorrow's All-Electrical Home" (EW, Jan. 17, p 15) sounds like a "Salesman's Dream" but also looks like an engineering abortion and is no credit to a responsible engineer or architect.

This is the kind of work that discredits both professions in the public eye and gives the public the wrong idea of the salesman (A money grabber).

C. T. Blackmore

Thacher Shore Road
Yarmouth Port, Mass.

## FPC Free to Rule on Hells Canyon

To the Editor:

Page 54 of the Dec. 27, 1954, issue contained some editorial comments about the Federal Power Commission and the development of the Hells Canyon stretch of the Snake River in Idaho.

It is our opinion that the author of this article has made two erroneous assumptions.

First he has assumed that the Administration's power policies necessarily preclude development of the Hells Canyon site by the federal government. The President in his State of the Union message, Jan. 6, 1955, clearly stated: "Third, the federal government must shoulder its own partnership obligations by undertaking projects of such complexity and size that their success requires federal development."

Section 7 (b) of the Federal Power Act provides that: "Whenever, in the judgment of the Commission, the development of any water resources for public purposes should be undertaken by the United States itself, the Commission shall not approve any application for any project affecting such development, but shall cause to be made such examinations, surveys, reports, plans, and estimates of the cost of the proposed development as it may find necessary, and shall submit its findings to Congress with such recommendations as it may find appropriate concerning such development. (41 Stat. 1067, 49 Stat. 842; 16 U.S.C. 800)"

It is obvious that it is our duty to determine on the evidence of record whether or not, in our judgment, the instant case falls under Section 7 (b). We see no inconsistency between this statute and the President's policy above stated.

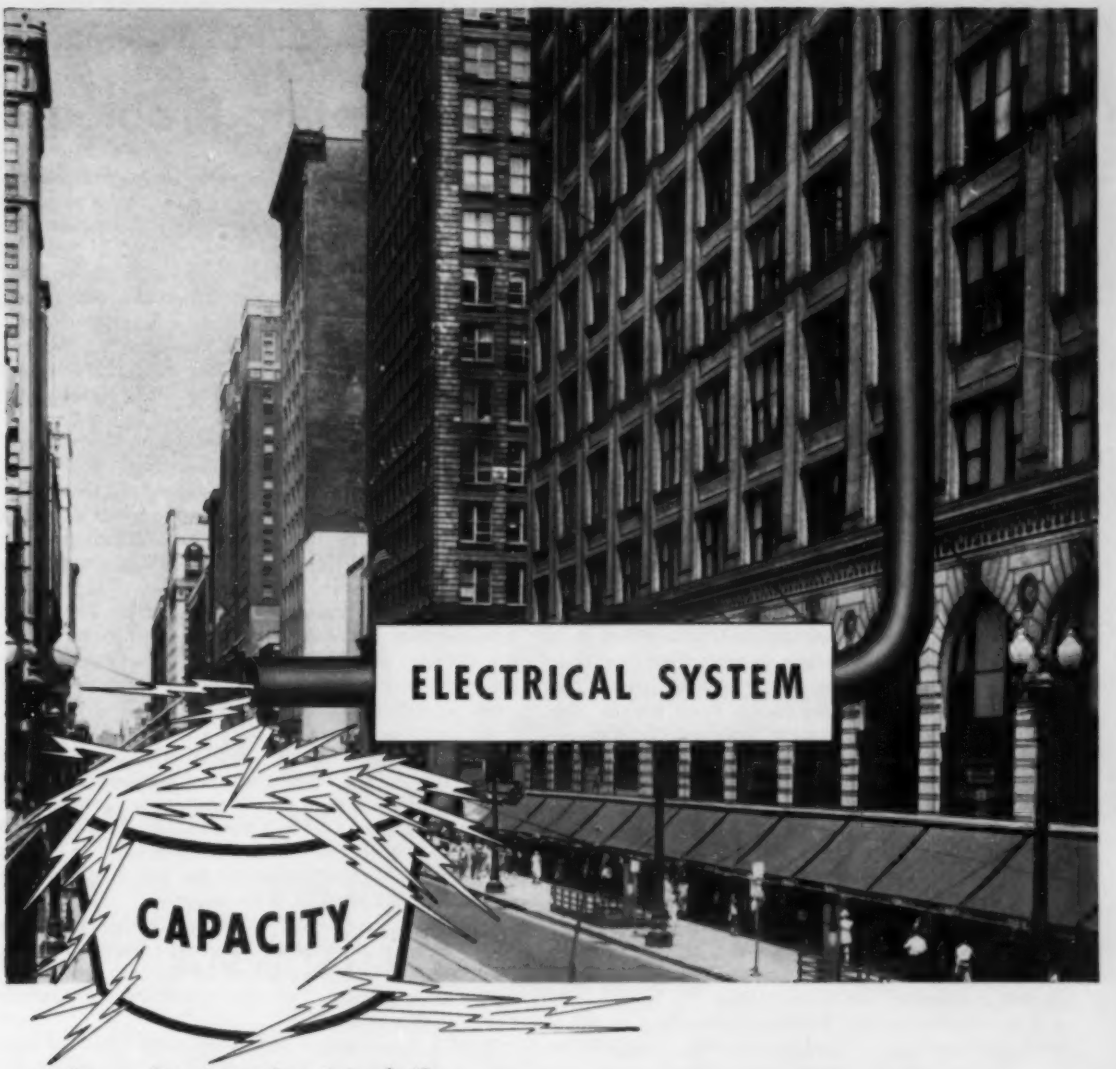
The second assumption which we deem erroneous is that the views of the Administration, even if they were determinative of this question, would be blindly and subserviently followed by the majority of the members of the commission. The commission is an agency of Congress, as distinguished from the Executive Branch of the government. All members have a fixed term and are under no legal, moral, or political compulsion to follow the views of any member of the Executive Department.

Furthermore, neither President Eisenhower nor any member of his Administration has endeavored directly or indirectly to exert pressure on this commission regarding the Hells Canyon matter or any other issue which has been before the commission.

For the commission.

Jerome K. Kuykendall
Chairman

Federal Power Commission
Washington 25, D. C.

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## WASHINGTON COMMENT

# Can REA Solve Clark Hill Marketing Problem?

Federal administrators are eager to get negotiations off dead center for marketing power in Georgia from the federally owned dam at Clark Hill. Unofficial word here in Washington is that the Rural Electrification Administration has stepped in with a new approach to solving the touchy problem which the Republicans inherited from the Truman Administration.

For the present, government spokesmen are mum on the REA suggestion, throwing some doubt on the possibility of any novel or quick solution to the old problem. It is known that REA Administrator Ancher Nelsen has discussed the problem with interested parties but the nature of the discussions remains private.

**Large Loans Discounted . . .** One safe bet is that the REA scheme does not involve any wide-scale construction of government-financed transmission lines throughout the state. Some speculation here has been to that effect.

Such a scheme would be fantastically uneconomic and put the co-ops in worse shape financially than if they chose to build small generating plants to serve their own loads. There is not sufficient firm power available from Clark Hill to serve the needs of the co-ops, much less the other preference customers. But more important, the transmission facilities to carry power to any appreciable number of co-ops would cost millions of dollars and duplicate lines now operated by Georgia Power Co.

Hence, for economic reasons alone it is safe to discount any possibility that REA will offer to loan funds to build independent transmission facilities for co-ops in the state.

What is more such a scheme would fly in the face of Administration power policy which is opposed to changing the power marketing pattern within an area. Georgia Power now serves all or most of the co-ops in Georgia as well as many of the municipalities.

It is a better bet that Nelsen is counselling co-ops to work out some plan of cooperation with Georgia Power Co. This has been his general policy since he came into office. In several instances, notably in Kentucky, he has helped patch up disputes between co-ops and electric companies—thus paving the way for the co-ops to secure adequate supplies of energy at reasonable rates from company facilities.

Whether Nelsen has some other suggestion or some compromise plan for solving the Clark Hill situation remains to be seen. Any plan acceptable to the co-ops, the government, and Georgia Power would certainly be welcomed by all sides and especially by the government administrators charged with marketing Clark Hill power in Georgia.

Negotiations have been stalled on contracts for disposal of Clark Hill power in Georgia since the last week of the Truman Administration. At that time the then Secretary of Interior Oscar Chapman refused to accept a contract under which Georgia Power would buy the Georgia share of power from Clark Hill and distribute it at government-set rates to the co-ops.

A tri-contract proposal put forward by the Republican Administration last March was turned down by the co-ops. It would have given title to the power to the Georgia utility but would have prescribed the rate and distribution of the power to preference customers.

**Contract May Set Pattern . . .** The Clark Hill power marketing situation has attained national prominence because utility men look to it to set the pattern for federal power marketing contracts. Georgia Power Co has held firm to its position that it will not "wheel" federal power over its lines under terms which would permit the federal government to take over customers from the company.

The co-ops, represented by former Georgia Gov Ellis Arnall, have sought to obtain title to the Georgia share of Clark Hill power at the busbar. In this way they hoped to be able to negotiate "wheeling" contracts with Georgia Power on their own terms.

If REA Administrator Nelsen can come up with a solution to this dilemma, he stands to win recognition far beyond the confines of his present office.

## TECHNICAL NOTES

**Preheating of alternator fields** should not be done at standstill lest the collector rings be damaged. Preheating with the unit on turning gear may overload the turning gear motor if the generator is connected to its transformer because of the additional torque imposed by the excitation losses in the transformer primary.

**Bonding of pipe-type cable** to other external ground paths will not change single-phase impedance values measurably because an almost negligible portion of the return current flows in the external circuit.

**TV watchers may be disturbed** by shrinkage of audio and video if station regulators are given full-range buck-to-boost-to-buck test while popular programs are on.

**Transmitting 500 Mw for 400 miles** at 0.8 load factor costs about the same per kwhr as the base generator cost in typical areas.

**Higher plant and system capabilities** necessitate corresponding increase in interconnection capabilities if the benefits derivable from interconnection are to be sustained.

# HOW TO SQUEEZE JUICE FROM AN ATOM

The key to harnessing the power of the atom lies largely in the economic design of the power reactor. *NDA* has been a leader in reactor design and engineering since 1948—longer than any other independent private enterprise. For example, the large-scale atomic power plant being planned by the Detroit Edison Company and its associated companies will employ an advanced reactor for which much of the nuclear engineering and physics has been evolved in the engineering offices and laboratories of *NDA*. Many other reactor designs, ranging from small units for research to large-scale power reactors capable of producing 200,000 kilowatts of electricity, have been conceived and designed by *NDA*.

Technological contributions such as these have been made possible by the coordinated efforts of *NDA*'s highly trained team of scientists, engineers and technicians. Their capabilities in the fields of research, design, development and engineering have been demonstrated repeatedly by their past achievements. Before your company initiates any project requiring advanced nuclear technology, consult *NDA* for expert counsel.

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# Present 'Fair Value' Recognized

**Britain's telephone service uses RCN depreciation to prevent capital erosion, "The Economist" magazine points out**

One of the oldest (some 40 years) of Britain's nationalized industries, the telephone service, operated as part of that country's postal service, has given full recognition that only depreciation based on reproduction cost of property (RCN) can prevent the erosion of capital.

Full credit in bringing the above conclusions to the attention of America's private utility industry must be given to "The Economist" published in England. In its issue of Dec. 11, 1954, in an article named "In Search of Telephones," a short but penetrating analysis is made of the problems facing the telephone department of the British Post Office. At the same time it demolished some of the finely spun theories of the proponents of original cost accounting who believe that all dollars are the same without regard to their purchasing power.

## Postal Service Losses

This article, in analyzing the post office commercial accounts for 1953-1954, states in part "The commercial accounts appear reassuring. Certainly there has been no attempt to imitate America to the slavish extent of running postal services at an enormous loss (though telephones are a thriving commercial business). The post office has shared in the prosperity of the country and a modest, but modestly growing, profit is handed over, which must go far to make up for the tax immunity enjoyed."

The article goes on to say that, while a small surplus has been accumulated, "The accounts are drawn after depreciation charged on the 'straight line' basis, that is by writing off a fixed proportion of the original cost of each capital asset each year through its calculated life until at the end the value has been expunged from the balance sheet. There is also in the telephone account alone an additional provision *'towards meeting the heavy costs of renewal of plant which will have to be met in future years'* (Italics supplied). This year the addition is £1.5 million. A year ago it was £1.0 million.

"For seven years now the post office telephone account," the article said, "has been quietly tucking away small sums for additional depreciation. Leaders of progressive private industry will note that the civil servants who run the post office decided that depreciation allowances that only provided for the replacement of prewar assets at prewar prices, were nonsense and would, if continued, mean living on capital, about as soon as the industrialists themselves made the same discovery.

"The Treasury has allowed the post office to make this furtive concession to financial orthodoxy for which the British tax system makes no provision. . . . It was also a provision that cost the Treasury nothing, whereas when private industry does it, it has to use money on which tax has been paid."

The article goes on to say: "It is evident . . . that the extra allowance of £1½ million together with straight line depreciation is not enough to replace the physical assets at present costs as they wear out. Therefore public capital is being consumed faster than it is replaced; the £7.4 million surplus is not in strict logic a profit at all; and the telephone service at its present price contains an element of subsidy."

## Depreciation Deficiency

Dealing with this deficiency in depreciation and with the cost of service, the article goes on to say: "It is much more difficult to decide what is the proper figure that the telephone service ought to draw from the public by way of charges and plough back in order to prevent erosion of its capital. The telephone account has fixed assets of a prime cost of £514 million and now written down to £337 million. Indices of plant costs would suggest that if they were all prewar assets due for replacement at present costs the provision would have to be multiplied by nearly three. On that assumption the present depreciation charge of £24½ million (£23 million plus the special allocation of £1½ million) would need to be raised to £69 million. Fortunately they were not all prewar assets; half the telephones in the country are of postwar origin and

# Utility Bill Tax Suggested

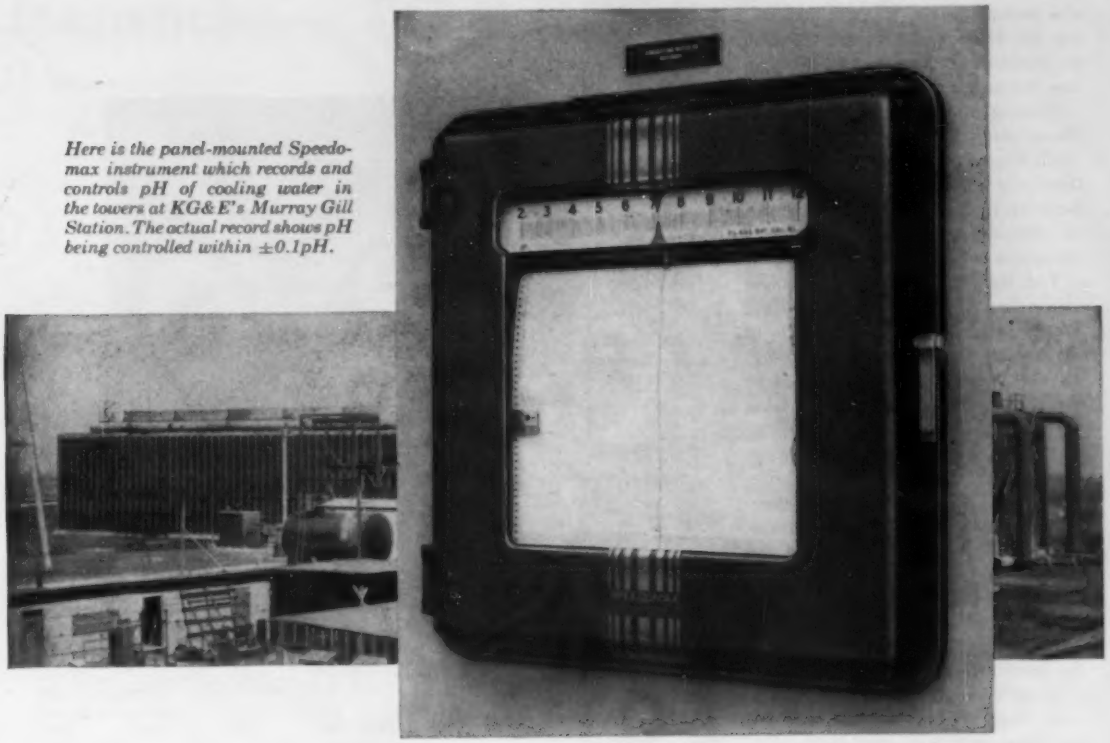
States of Washington and Pennsylvania are considering placing a tax on utility bills to raise additional funds. A 5% surcharge on electric, gas, and water bills may be imposed in Washington if the legislature, now in session, follows a suggestion of Gov Arthur B. Langlie. Electric and gas bills in Pennsylvania would be taxed 3½% under a proposal of the state's tax study committee.

Gov Langlie expressed that he "likes" the utilities tax "from the standpoint of being the easiest and the least costly to collect" and having a minimum effect on the state's economy. The tax would raise an estimated $10 million a year, half of the additional $20 million annually declared needed by the state.

A 5% surcharge would increase taxes now paid on gross income by power companies to 8.3%. It would cost the average homeowner about 30¢ more a month, the governor estimated.

Municipalities generating their own power are expected to fight the proposed tax. A spokesman for one of them declared that such a tax "would result only in shunting more industrial customers away from locally owned companies. The only benefit would be to the federal generating system, which would not be sharing this added burden."

The levy in Pennsylvania, which would apply to electric and gas bills, would bring in an estimated $14 million.



*Here is the panel-mounted Speedomax instrument which records and controls pH of cooling water in the towers at KG&E's Murray Gill Station. The actual record shows pH being controlled within ±0.1pH.*

# pH is no problem

## IN THIS COOLING TOWER

**The once troublesome problem** of effectively controlling the pH of cooling tower water has been solved in the towers at the Murray Gill and Ripley Stations of Kansas Gas and Electric Company.

Various other control arrangements, on similar tower systems, have been tried . . . with varying degrees of success. But the present system at KG&E demonstrates that, with the application of L&N's Controllability Analysis and practical engineering principles, a cooling tower system can work *for*, rather than *against*, full-function control of pH.

The benefits of effective pH control are readily apparent at KG&E. According to a report from the company's Production Department, they include "conserving large amounts of make-up water, wood protection, prevention of carbonate scale, and more effective slime control." The report adds that "automatic pH control at both plants has been effective and satisfactory."

We'll be glad to discuss your cooling tower pH control questions with you. Write for Process Data Sheet 700(1) which explains "L&N pH Control of Cooling Tower Water." With it, you'll receive a Controllability Analysis Questionnaire which will help us to analyze the controllability factors of your towers. Fill out the Questionnaire and return it, without obligation, to Leeds & Northrup Co., 4938 Stenton Ave., Philadelphia 44, Pa.

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it is perhaps fair to suppose that taking the old equipment with the new an increase of the order of 50% in the depreciation charge is needed."

Dealing with the pricing of telephone service, the article concludes: "It is no mere coincidence that there usually is a queue for the article that happens to be artificially cheapened, or that when subsidy is withdrawn the queue soon disperses."

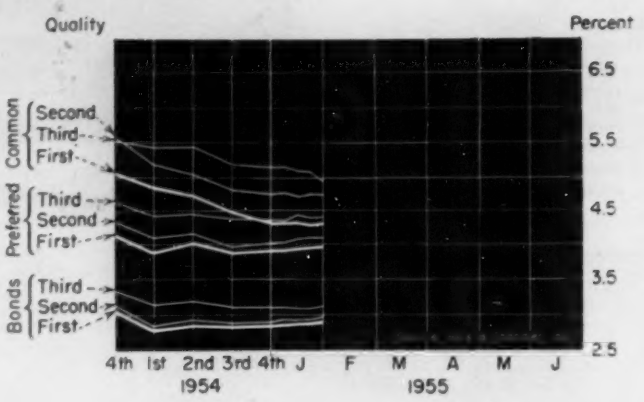
The significance of the foregoing article lies, of course, in the fact that even in England, wedded as it is to the original cost theories of accounting as well as to a system of socialized public service, recognition has been given to the fact that the laws of economics do not distinguish between government and private enterprise. The claims of some accounting theorists that only original cost depreciation measures the cost of service and nothing less, fall by the wayside when the real purpose of depreciation is finally recognized; namely, the preservation of the integrity of property and the continuation of the enterprise as a going concern. This can only be done when depreciation measures the consumption of true economic capital instead of inflated investments.

## FINANCIAL BRIEFS

**Shawinigan Water & Power Co** is offering 219,595 common shares to its stockholders on a 1-for-10 basis, record Jan. 31 to expire on Feb. 28 at $46 a share . . . **Cassville, Wis., citizens** voted 339 to 3 to sell its municipal electric system to Wisconsin Power & Light Co for $33,578, subject to adjustments . . . **Commonwealth Edison Co** directors voted to distribute its holdings of 4,982,115 common shares of Northern Illinois Gas Co to Edison's stockholders. Distribution will be made on or about March 1 to stockholders of record Feb. 2 at the rate of three shares of gas company stock for each ten shares of Edison stock.

**Dominican Republic** government has purchased the American-owned Santo Domingo Electric Co for $13.2 million . . . **Long Island Light Co** has arranged with 28 local banks in New York City and Long Island area a revolving credit totaling $35 million to extend to Dec. 31, 1955.

## Today's Utility Yields—(%)




| | BONDS | | | Preferred Stocks | | | Common Stocks | | |
|---|---|---|---|---|---|---|---|---|---|
| QUALITY..... | 1st | 2nd | 3rd | 1st | 2nd | 3rd | 1st | 2nd | 3rd |
| Jan. 27..... | 2.93 | 2.98 | 3.12 | 3.98 | 4.09 | 4.41 | 4.33 | 4.75 | 4.97 |
| Jan. 20..... | 2.93 | 2.97 | 3.11 | 3.98 | 4.09 | 4.40 | 4.34 | 4.74 | 5.09 |

## Utility Earnings

| COMPANY | PERIOD MONTHS | ENDED | NET INCOME 1954 | NET INCOME 1953 | EARNINGS PER COMMON SHARE 1954 | EARNINGS PER COMMON SHARE 1953 |
|---|---|---|---|---|---|---|
| Central Illinois Light..... | 12 | Dec. | $3,535,701 | $3,236,250 | $3.03 | $2.73 |
| Central Vermont Public Service | 12 | Dec. | 1,362,344 | 963,708 | 1.27(a) | .92(a) |
| Consumer Power..... | 12 | Dec. | 26,551,696 | 24,836,390 | 3.10(b) | 3.16(b) |
| Houston Lighting & Power.... | 12 | Dec. | 13,112,631 | 10,311,739 | 2.30 | 1.99 |
| Iowa Southern Utilities..... | 12 | Dec. | 1,201,588 | 1,341,386 | 1.44(c) | 1.64(c) |
| Minnesota Power & Light..... | 12 | Dec. | 3,551,138 | 4,078,567 | 1.73 | 2.04 |
| Montana Power & subsidiaries. | 12 | Dec. | 7,392,229 | 7,452,363 | 2.53 | 2.62 |
| Oklahoma Gas & Electric..... | 12 | Dec. | 6,974,674 | 5,997,285 | 2.18 | 1.90 |
| Southern Co. consolidated..... | 12 | Dec. | 23,368,065 | 22,369,897 | 1.29 | 1.23 |
| Southern Indiana Gas & Electric | 12 | Dec. | 2,468,093 | 2,119,592 | 2.25(e) | 2.14(e) |

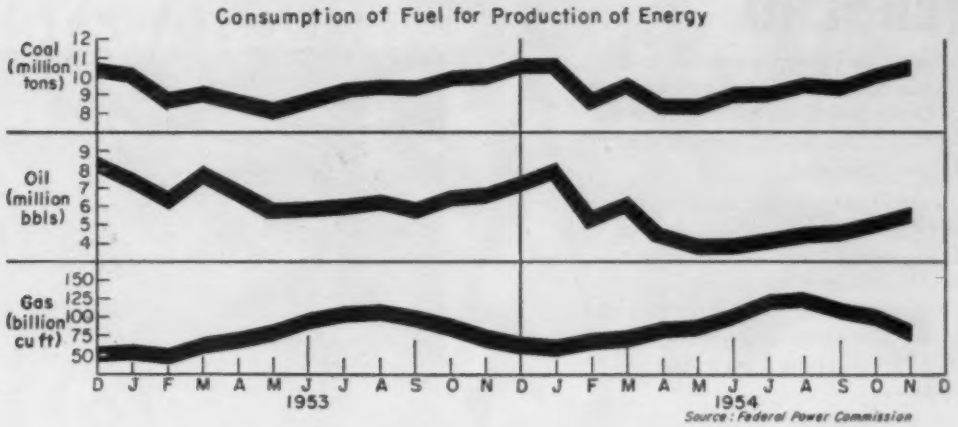
Notes—All the figures in the above companies are subject to year-end audit; (a) Based on 867,141 shares in 1954 and 814,721 shares in 1953; (b) Based on 7,473,798 shares in 1954 and 6,794,362 shares in 1953; (c) Based on 745,751 shares in 1954 and 736,065 shares in 1953, and (e) Based on 913,333 shares in 1954 and 799,167 shares in 1953.

## Utility Financing

| COMPANY AND DESCRIPTION | AMOUNT OF OFFERING (000) | OFFERING PRICE | YIELD TO PUBLIC |
|---|---|---|---|
| WEEK OF JANUARY 26—FEBRUARY 2 | | | |
| BONDS | | | |
| Los Angeles, Calif., Department of Water and Power electric plant revenues due 1956-85..... | $18,000 | various | 1.00-2.65% |
| SCHEDULE FOR FEBRUARY—MARCH | | | |
| BONDS AND DEBENTURES | | | BID DATE |
| Dallas Power & Light—debs due 1980..... | $7,000 | ..... | Feb. 14 |
| Kansas City Power & Light—1st mtg due 1985..... | 16,000 | ..... | Feb. 15 |
| Central Electric & Gas—conv. debs due 1970..... | 1,500 | ..... | Feb. 17(a) |
| Texas Electric Service—1st mtg due 1985..... | 17,000 | ..... | Feb. 23 |
| Kansas Gas & Electric—1st mtg due 1985..... | 10,000 | ..... | Mar. 15 |
| Pacific Gas & Electric—1st mtg 1987..... | 80,000 | ..... | * |
| PREFERRED STOCK | | | |
| Kansas Gas & Electric—60,000 sh $100 par..... | $6,000 | ..... | Mar. 15 |
| COMMON STOCK | | | |
| Central & South West—600,000 sh..... | ..... | ..... | Mar. 1 |

Note—* Early in March; (a) Paine, Weber—Stone & Webster group, underwriters.

# STATISTICS



Source: Federal Power Commission

## Power Statistics . . .

| | | | Latest Month | Preceding Month | Year Ago | Annual Change % |
|---|---|---|---|---|---|---|
| Capacity | million kw | Dec. | 102.52 | 101.12 | 91.49 | 12.1 |
| Peak—Class I Systems | million kw | Nov. | 81.9 | 79.9 | 75.3 | 8.8 |
| Estimated Dec. '55 Peak | million kw | Nov. | 96.1 | 96.2 | 98.3 | − 2.2 |
| Production—billion kwhr | | Nov. | 40.22 | 40.46 | 36.43 | 10.4 |
| hydro | | | 8.12 | 7.83 | 6.99 | 16.4 |
| fuel | | | 32.10 | 32.63 | 29.44 | 9.0 |
| Sales—billion kwhr | | Nov. | 33.87 | 33.75 | 31.59 | 11.5 |
| residential | | | 10.07 | 9.70 | 9.02 | 11.5 |
| commercial | | | 6.14 | 6.40 | 5.50 | 8.8 |
| industrial | | | 15.38 | 15.24 | 14.95 | 4.5 |
| other | | | 2.29 | 2.41 | 2.12 | 7.5 |
| Fuel Consumption | | Nov. | | | | |
| coal—million tons | | | 10.70 | 10.34 | 10.19 | 3.5 |
| oil—million barrels | | | 5.82 | 5.32 | 6.91 | −15.8 |
| gas—billion cu ft | | | 88.66 | 108.49 | 80.58 | 10.0 |
| Net Income Class A & B Co's—$ million | | Nov. | 94.90 | 86.92 | 83.86 | 13.2 |
| Residential Customers—millions | | Nov. | 43.04 | 42.95 | 41.89 | 2.8 |
| revenue per kwhr | | | 2.70¢ | 2.70¢ | 2.74¢ | − 1.5 |
| avg kwhr per customer | | | 2,528 | 2,512 | 2,332 | 8.4 |
| avg. annual bill | | | $68.26 | $67.82 | $63.90 | 6.8 |

## Business Statistics . . .

| | | | | | |
|---|---|---|---|---|---|
| Indexes: 1947—49 = 100 | | | | | |
| FRB Industrial Production | Dec. | 128 | 130 | 124 | 3.2 |
| ENR Construction Cost | Dec. | 134.9 | 134.8 | 128.2 | 5.2 |
| BLS Cost-of-living | Nov. | 114.6 | 114.5 | 115.0 | − 0.3 |
| NEMA Sales | Nov. | | | | |
| insulation materials | | 124 | 117 | 130 | − 4.6 |
| electric appliances | | 90 | 102 | 70 | 28.6 |
| household refrigerators | | 47 | 51 | 35 | 34.3 |
| Wholesale prices | Dec. | | | | |
| motors and generators | | 121.7 | 121.7 | 124.3 | − 2.1 |
| transformers and regulators | | 128.1 | 128.1 | 128.1 | ..... |
| switchgear and fuses | | 135.3 | 135.3 | 135.1 | 0.1 |
| GNP—annual rate—$ billion | 3rd qtr | 355.5 | 356.0 | 367.2 | − 3.2 |

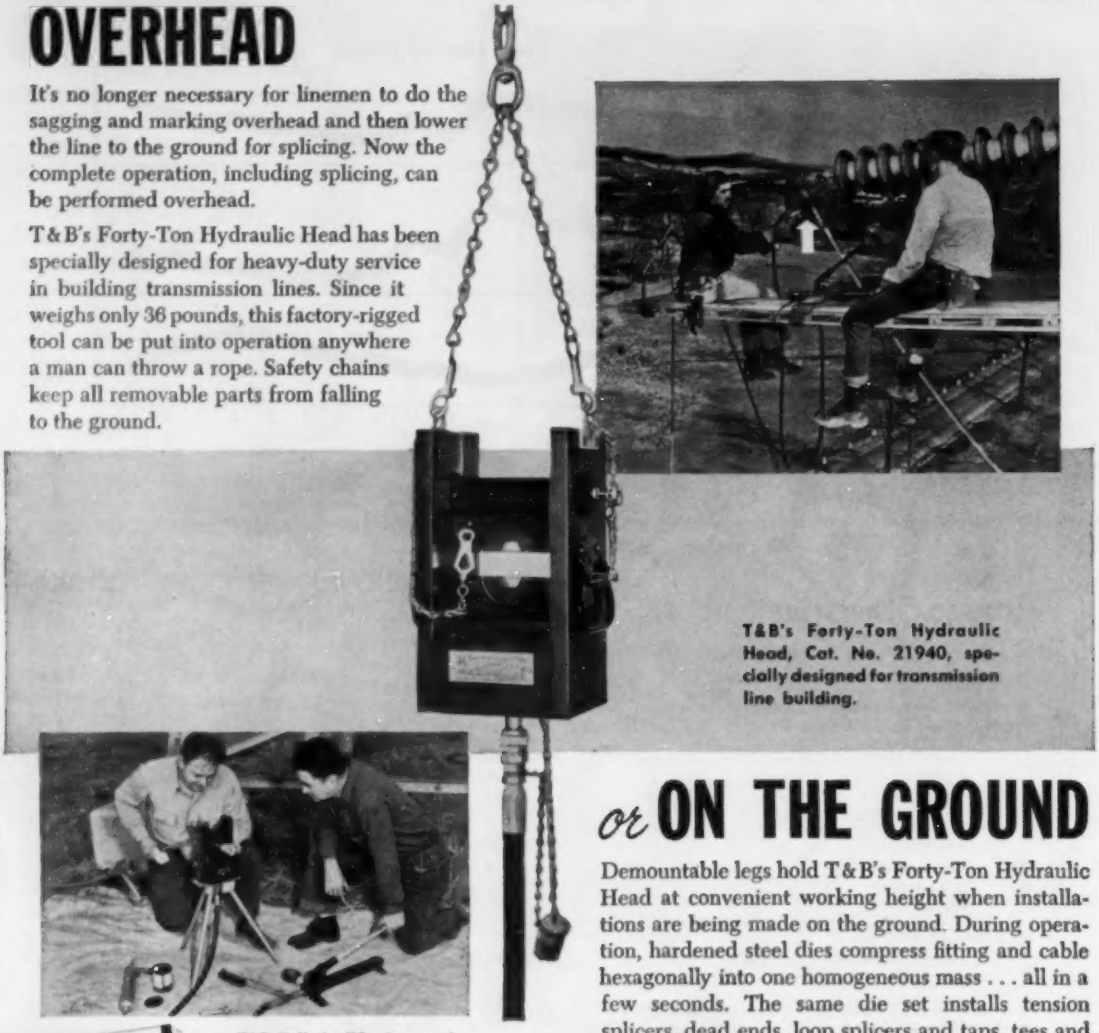
## Now *ONE* portable tool makes transmission line splices

# OVERHEAD

It's no longer necessary for linemen to do the sagging and marking overhead and then lower the line to the ground for splicing. Now the complete operation, including splicing, can be performed overhead.

T&B's Forty-Ton Hydraulic Head has been specially designed for heavy-duty service in building transmission lines. Since it weighs only 36 pounds, this factory-rigged tool can be put into operation anywhere a man can throw a rope. Safety chains keep all removable parts from falling to the ground.





T&B's Forty-Ton Hydraulic Head, Cat. No. 21940, specially designed for transmission line building.

# *or* ON THE GROUND

Demountable legs hold T&B's Forty-Ton Hydraulic Head at convenient working height when installations are being made on the ground. During operation, hardened steel dies compress fitting and cable hexagonally into one homogeneous mass . . . all in a few seconds. The same die set installs tension splicers, dead ends, loop splicers and taps, tees and terminals.

Modern hydraulic design has virtually eliminated the need for maintenance. However, field maintenance is simple and practical. The 21940 Installing Head can be completely disassembled and reassembled in less than one-half hour with these common tools: screw driver, Allen wrench, and mallet.

T&B Bulletin 70 gives a detailed description of the Forty-Ton Hydraulic Head as well as complete lines of T&B connectors, tools, and accessories for transmission line building. Send for FREE copy.

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**IT'S THE MARK OF AN AUTHORIZED T & B DISTRIBUTOR**

The complete line of T&B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs. T-418

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**INCORPORATED**

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**MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898**

# FACTS ABOUT Exide®
## MANCHEX® BATTERIES

## POSITIVE OPERATION
### OF CIRCUIT BREAKERS IS ASSURED BY EXIDE-MANCHEX BATTERIES

HIGH-POWER TESTS AT THE SWITCHGEAR LABORATORY HELP GENERAL ELECTRIC ENGINEERS IN DESIGNING ALL SIZES OF CIRCUIT BREAKERS AND OTHER SWITCHING EQUIPMENT. THE BATTERY USED FOR TRIPPING AND CLOSING BREAKERS IN THIS DEVELOPMENT WORK ARE EXIDE-MANCHEX. THEY PROVIDE THE MOST DEPENDABLE AND DURABLE SOURCE OF POWER FOR UNFAILING OPERATION OF VITAL ELECTRICAL EQUIPMENT.

## SINCE 1889, EXIDE ENGINEERS

HAVE EXPERIMENTED WITH THOUSANDS OF BATTERY IDEAS. THE RESULT IS THE HIGH QUALITY EXIDE-MANCHEX BATTERY NOW SO WIDELY USED BY ELECTRIC UTILITIES THROUGHOUT THE U.S.

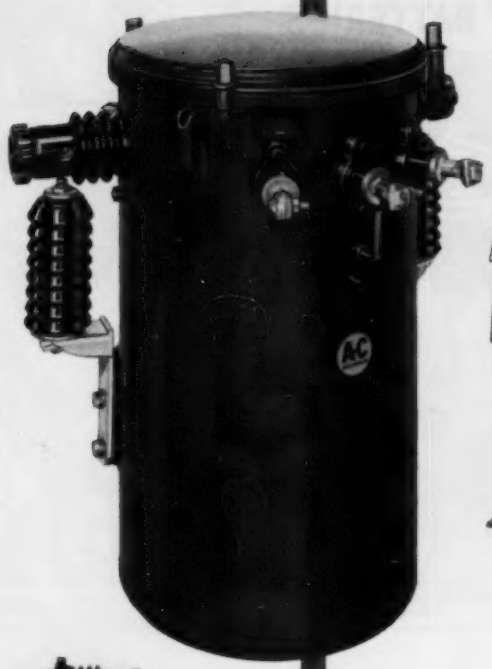
## BUTTONS OF LEAD
### PROVIDE DEPENDABLE POWER... LONGEST BATTERY LIFE

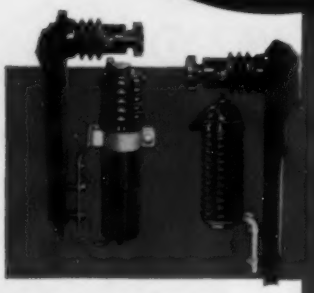
THE IMPROVED PLANTE TYPE POSITIVE PLATES OF THE EXIDE-MANCHEX BATTERY ARE OF MANCHESTER DESIGN-AN EXCLUSIVE EXIDE FEATURE. BUTTONS OF LEAD DELIVER THE POWER YOU NEED, WHEN YOU NEED IT. OVER A HALF CENTURY OF DEPENDABLE PERFORMANCE IN ELECTRIC UTILITY STATIONS HAS DEMONSTRATED THAT EXIDE BATTERIES WITH THEIR BUTTONS OF POWER ARE YOUR BEST BATTERY BUY-AT ANY PRICE!

LET EXIDE HELP SOLVE YOUR SWITCHGEAR BATTERY PROBLEMS. ❶ CALL AN EXIDE SALES ENGINEER FOR FULL DETAILS. ❷ WRITE FOR BULLETIN 210-WHICH TELLS HOW BATTERIES ARE MOST EFFICIENTLY USED IN SWITCHGEAR OPERATIONS.

**Exide INDUSTRIAL DIVISION,** The Electric Storage Battery Company, Philadelphia 2, Pa.

# ACP Transformers





- **Simpler Installation**
- **Less Maintenance Cost**
- **More Transformer Capacity**

## Allis-Chalmers lets you choose your lightning arrester

Either valve-type or expulsion lightning arresters are available on ACP transformers. You may select the exact arrester you prefer. An air gap between arrester and bushing assures that arrester is never energized except during lightning discharge. The result is reduced possibility of radio interference and longer arrester life.

HERE ARE SOME OF THE WAYS your system benefits when you use Allis-Chalmers *Protected* transformers: Maintenance costs decrease because many fuse-replacing trips are eliminated — circuit breakers now do the job. And you get more capacity from each transformer because premium protection lets you work closer to the maximum capacity. A convenient signal gives plenty of warning when overload conditions exist.

### Complete Package

Best of all, this premium protection comes in a single, easy-to-handle package. Lightning arresters, gaps, low voltage circuit breakers, and protective links are built in. Installation is simpler than with a conventional distribution transformer. There are no extra accessories, nothing else to buy.

There are advantages in extended transformer life, too. Find out all about how ACP transformers pay off in better system operation, lower overall costs. Consult your nearby A-C district office or write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 61B7309B. A-4545

ACP is an Allis-Chalmers trademark.

**ALLIS-CHALMERS**